

**DIVISION 5 SURFACE TREATMENTS AND PAVEMENTS****SECTION 5-01 SUBSEALING****5-01.1 DESCRIPTION**

Section 5-01 describes work consisting of filling voids under existing cement concrete pavement and rigid base asphalt pavements by pumping a mixture of Portland cement, pozzolan, or fly ash, and water under the pavement slabs.

**5-01.2 MATERIALS**

Materials shall meet the requirements of the following Sections:

Portland Cement and Pozzolan	9-01
Fly Ash	9-23.9
Water	9-25

**5-01.3 CONSTRUCTION REQUIREMENTS****5-01.3(1) PROPORTIONING MATERIALS**

The standard mix design for subsealing is as follows:

1 part (by volume)	Portland cement Type I or II
3 parts (by volume)	pozzolan (natural or artificial)
2.25 parts (by volume)	Water

Any deviation from the above mix design shall be approved by the Engineer. The water content may be varied by the Contractor as required for local conditions.

**5-01.3(2) EQUIPMENT**

All Equipment used in performance of subsealing shall be subject to the approval of the Engineer and shall be maintained in satisfactory working condition at all times.

Air compressors to be used for operating air hammers, and for blowing air into the cavities beneath the pavement, shall be of sufficient size and capacity for acceptable performance.

Air hammers shall be equipped with drills that are capable of cutting 1-1/2 inch diameter holes through the pavement. The Equipment shall be in good working condition and operated in such a manner that out-of-round holes shall not be produced.

The grout plant shall consist of a cement injection pump and a high speed colloidal mixing machine. The colloidal mixing machine shall operate at a minimum speed of 1,200 rpm and shall consist of a rotor operating in close proximity to a stator, creating a high shearing action and subsequent pressure release to make a homogeneous mixture.

The dry Material shall be accurately measured, and the water shall be batched through a meter or scale with a totalizer for the day's consumption.

Wooden cylindrical plugs or other devices approved by the Engineer shall be provided to temporarily plug the application holes until the Material has set. The plugs shall be slightly tapered on one end for ease in driving.

**5-01.3(3) CONSTRUCTION**

Subsealing shall not be done when the pavement is wet, or when water is present under the pavement. Application holes shall be drilled through the cement concrete pavement in the approximate pattern as indicated on the Drawings.

Application holes shall be approximately 1-1/2 inches in diameter and shall be perpendicular to the pavement surface. The Contractor shall not drill more holes in a day than can be filled or temporarily plugged during the same day. To prepare the cavity for injection of the subsealing mix Materials, compressed air shall be blown through the application holes for not less than 15 seconds and not more than 60 seconds. After the application holes are blown out and the nozzle is firmly wedged into the hole, the subsealing mix shall be pumped into the application hole until all cavities are filled, or until any one of the following occurs:

1. A pavement slab or portion of a slab starts to rise.
2. Subsealing mix extrudes from adjacent application holes, or along or outside the longitudinal edges of the pavement.
3. The Engineer orders application of subsealing mix stopped. Immediately upon removal of the nozzle, the plug shall be inserted and firmly driven into the application holes.

Following the application and after the mix has set, the wooden plugs shall be removed and the application holes immediately filled with subsealing mix.

Subsealing shall be continued progressively through the pavement requiring subsealing.

Traffic shall not be allowed upon any subsealed area until the subseal has hardened.

In the event the Engineer determines that continued injection at any specific location is no longer economically feasible, the Contractor shall cease operations and move to a new location.

**5-01.4 MEASUREMENT**

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for "Pavement Subseal" will be by the cubic foot of dry Materials used before the addition of water or other additives.

Measurement for "Drill Hole for Subsealing" will be by each hole drilled completely through the pavement.

**5-01.5 PAYMENT**

Compensation for the cost necessary to complete the work described in Section 5-01 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. "Drill Hole for Subsealing", per each.

The Bid item price for "Drill Hole for Subsealing" shall include all costs for the work required to drill the holes.

2. "Pavement Subseal", per cubic foot.

The Bid item price for "Pavement Subseal" shall include all costs for the work required to complete the subsealing.

**SECTION 5-02 BITUMINOUS SURFACE TREATMENT****5-02.1 DESCRIPTION****5-02.1(1) GENERAL**

Section 5-02 describes work consisting of constructing a single or multiple course bituminous surface by treating existing crushed rock, screened gravel or bituminous roadway surfaces with liquid asphalt and covering with a Mineral Aggregate thoroughly cemented to the roadway to obtain a wearing surface with good riding and nonskid qualities.

Roadway surfaces shall be classified as treated or untreated roadway surfaces. A "treated" surface is defined as a paved surface consisting of asphalt concrete, cement concrete, brick, or seal coat. An "untreated" surface is defined as an unpaved surface which may consist of gravel, crushed rock or oil mat surfaces. Surfaces may be existing or new construction.

Bituminous surface treatment method shall be Class B unless specified otherwise in the Contract.

**5-02.1(2) BITUMINOUS SURFACE TREATMENT CLASS A**

This method of treatment requires two applications of asphalt and three applications of aggregate. The second application (tack coat) shall be applied after the first application of prime coat has cured and all loose aggregate has been removed.

**5-02.1(3) BITUMINOUS SURFACE TREATMENT CLASSES B, C, AND D**

These methods require the placing of one application of asphalt and one or more sizes of aggregate as specified to an existing asphalt roadway to seal and rejuvenate the surface and to produce a uniform roadway surface with good nonskid characteristics.

**5-02.2 MATERIALS**

Materials shall meet the requirements of the following Sections:

Asphalt	9-02
Anti-Stripping Additive	9-02.4
Mineral Aggregates	9-03

The grade of asphalt shall be Cationic Emulsified Asphalt (CRS-2) meeting the requirements of Section 9-02.1(6).

Mineral Aggregate for Bituminous Surface Treatment Class A or Class B shall be Mineral Aggregate Type 24, Chip Rock, meeting the requirements set forth in Section 9-03.

When cutback asphalts are specified for Bituminous Surface Treatment Class A, construction shall not begin until the need for anti-stripping additive has been determined. The Contractor shall allow a minimum of seven Working Days after the SPU Materials Laboratory has received samples of the Mineral Aggregate, asphalt, and anti-stripping additive, for testing. Additional time will be required by the Engineer to verify acceptable performance and compatibility, if the Contractor has requested more than one source of asphalt or anti-stripping additive be approved. The Contractor shall take this into consideration in preparing for and meeting Contract Time.

**5-02.3 CONSTRUCTION REQUIREMENTS****5-02.3(1) EQUIPMENT**

The Equipment used by the Contractor shall include scarifying, mixing, spreading, finishing and compacting Equipment, an asphalt distributor, and Equipment for heating asphalt Material, and shall be subject to approval by the Engineer before its use on the Work.

The distributor shall have a capacity of not less than 1,000 gallons, and shall be so designed, equipped, maintained, and operated that asphalt Material of an even heat shall be uniformly applied at the required rate. It shall be equipped with a 10-foot spray bar with extensions, pressure pump and gauge, volume gauge so located as to be observed easily by the Engineer from the ground, a tachometer to control accurately the speed and spread of asphalt, and two thermometers, one installed permanently in the tank to indicate temperatures of the asphalt at all times. The power for operating the pressure

pump shall be supplied by a power unit which provides a uniform spray from each of the nozzles across the spray bar and extensions.

Rollers shall be self-propelled pneumatic-tired or smooth-wheeled rollers, each weighing not less than 10 tons.

Spreading Equipment shall be self-propelled, supported on at least four pneumatic tires, with an approved device for accurately metering and distributing the Mineral Aggregate uniformly over the roadway surface.

Brooms shall be motorized with a positive means of controlling vertical pressure.

Other Equipment necessary to acceptably perform the work as specified herein shall be subject to approval by the Engineer before its use on the Work.

Additional units shall be placed on the Work when, in the opinion of the Engineer, it is considered necessary in order to fulfill the requirements of these Specifications, or to complete the Work within the time specified.

Both the asphalt distributor and the self-propelled chip spreader shall be calibrated prior to their use to ensure applications within the specified coverage limits. Adjustment of the asphalt distributor spray bar height shall produce a triple lap of spray fans from bars with a 4-inch nozzle spacing and a double lap from bars having a 6-inch nozzle spacing.

The Contractor shall frequently check and adjust, if necessary, the height of the spray bar during asphalt application to insure the height above the pavement surface does not vary more than 1 inch as the truck load lightens.

#### **5-02.3(2) PREPARATION OF ROADWAY SURFACE**

##### **5-02.3(2)A UNTREATED SURFACES**

Refer to Section 5-04.3(5)C.

No traffic will be allowed on the repaired surface until the prime coat of asphalt and Mineral Aggregate is applied.

##### **5-02.3(2)B TREATED SURFACES**

Refer to Section 5-04.3(5)B.

##### **5-02.3(2)C SOIL RESIDUAL HERBICIDE**

The use of soil residual herbicide will not allowed.

#### **5-02.3(3) APPLICATION OF ASPHALT**

Upon the properly prepared roadway surface, Cationic Emulsified Asphalt (CRS-2) shall be applied in non-shaded areas at the rate of 0.35 to 0.40 gallon per square yard, and in shaded areas at 0.38 to 0.45 gallon per square yard. The asphalt spraying application temperature at the distributor shall be between 140°F and 185°F. The Engineer may vary the rate of asphalt application that will give the best results.

To ensure uniform distribution of asphalt prior to beginning the asphalt application, the distributor bar shall be operated over a pit or vat. To avoid gaps and ridges at transverse junctions of separate applications of asphalt, the Contractor shall spread sufficient building paper over the treated surface to make sure that the spray jets function normally when the untreated surface is reached.

The pattern of application of shots, and width and length of application of shots of asphalt Material shall be such as to provide proper coverage of crushed Material within the times specified, provide proper widths to such dimensions as to facilitate an acceptable coverage of crushed cover stone, and provide lapping of subsequent adjacent applications.

Asphalt shall be applied to spandrels of intersections and driveways immediately ahead of, or immediately behind the adjacent longitudinal street application.

Omissions (skips) by the distributor shall immediately be covered by hand application with the same grade of hot asphalt.

Any one spread of asphalt shall cover no more area than can be covered with Mineral Aggregate within 3 minutes from the time of application, upon any part of the spread.

Asphalt shall be spread toward the source of Mineral Aggregate to avoid injury to the freshly treated surface. No asphalt shall be spread until adequate supplies of Mineral Aggregate are on hand at the Project Site.

Where earth curbs or no curbs exist, the application of asphalt shall extend 4 inches beyond the gutter line. Where concrete curb and gutter exist, the application shall lap onto the gutter section, but shall not exceed 2 inches. Where concrete curb exists, the application shall be placed as closely as possible to the vertical surface without excessive splash onto the curb. Where concrete curb or curb and gutter exist, the distributor shall be equipped with a splash board designed to prevent spraying thereon.

All castings shall be protected by securely covering with heavy building paper and weighing down with sand or crushed Material.

Hand sprayers shall be used to apply asphalt around castings, and to areas where coverage is insufficient.

#### **5-02.3(4) CHANGE IN GRADES OF ASPHALT**

At any time during the progress of the asphalt construction, the Engineer may order the use of other grades of asphalt Materials in substitution of the grades specified in the Contract if the intent of the Specifications will be better attained.

#### **5-02.3(5) APPLICATION METHOD OF AGGREGATES**

Any method of handling the Mineral Aggregate which causes segregation of the various sizes of aggregate particles shall be corrected by the Contractor upon the request of the Engineer so that a uniform product is incorporated in the Work.

After applying the asphalt uniformly over the roadway surface, Mineral Aggregate of the Type specified shall be uniformly applied to the roadway surface at a rate of 25 to 33 pounds per square yard by spreader Equipment. The quantity of Mineral Aggregate to be applied shall be such that the asphalt shall be uniformly covered and shall not pick up under traffic. The Mineral Aggregate shall be uniformly applied over the freshly spread asphalt by trailer-type or self-propelled spreader boxes. The Mineral Aggregate shall be applied so that trucks and spreader boxes do not travel on the fresh asphalt and the Mineral Aggregate layer shall be spread in one operation for each application of asphalt. Spandrels of intersections, driveways, and bare spots shall be covered by hand spreading from trucks immediately behind the box application. Mineral Aggregate shall be spread in such a manner as to provide an 8-inch strip of asphalt exposed to provide a lap with the next application of asphalt.

The Mineral Aggregate shall be damp and shall be free of dust and impurities, when applied to the roadway. If the Mineral Aggregate is dry or dusty or both dry and dusty, the Contractor shall spray the aggregate with water to obtain a damp and dust free condition. Dusty or dry Mineral Aggregate which compromises adhesion of the Mineral Aggregate to the substrate will not be allowed.

As soon as the aggregate has been applied to the surface, the aggregate shall be well rolled with a self-propelled pneumatic-tired roller. Places inaccessible to the pneumatic-tired roller, such as spandrels of intersections and private driveways, shall be rolled with a self-propelled smooth-wheel roller.

Where excess Mineral Aggregate has been applied, it shall either be removed or be drifted uniformly over the adjacent roadway by using a motor patrol grader equipped with a wire broom mold board, subject to approval of the Engineer. This type of brooming shall be held to a minimum, and where necessary it shall be very carefully performed so as not to disturb the mat in any way. Thin or bare spots in the spread of Mineral Aggregate shall be corrected by hand spreading or by use of a grader as described above.

Rolling and brooming shall continue until the roadway is uniformly covered and the Mineral Aggregate is well compacted and "set" into the asphalt. This operation shall continue until the asphalt has cured to the extent that it does not "pick up" under traffic. During the maintenance period following the application of the Bituminous Surface Treatment, the Contractor shall perform brooming, spotting, and rolling as necessary to prevent "pick up" or other damage to the surface.

At any time during the progress of the Work, the Engineer may order the use of a different Mineral Aggregate grading in lieu of the Mineral Aggregate specified if in the Engineer's judgment the results contemplated by the Specifications will thereby be better attained.

#### **5-02.3(6) ADDITIONAL ASPHALT AND MINERAL AGGREGATE**

If the application of asphalt or Mineral Aggregate, or both, is insufficient or excessive for the required results, the Engineer may require the Contractor to make an additional application of one or both Materials in accordance with these Specifications.

#### **5-02.3(7) PATCHING AND CORRECTION OF DEFECTS**

Omissions by the distributor or damage to the treated surface of any coat shall be immediately covered by hand application with asphalt in adequate quantities. Holes which develop in the surface shall be patched in the same manner as specified in Section 5-04.3(5)C.

Defects such as raveling, lack of uniformity, or other imperfections caused by faulty workmanship shall be corrected and new work shall not be started until such defects have been remedied.

All improper workmanship and defective Materials resulting from overheating, improper handling or application, shall be removed from the roadway by the Contractor and shall be replaced with approved Materials and workmanship.

If the Engineer determines a fog seal is necessary at any time during the life of the Contract, the Contractor shall apply a fog seal of CSS-1 at the rate of 0.07 to 0.18 (0.02 to 0.05 residual) gallons per square yard. The emulsified asphalt shall be diluted with water at a rate of one part water to one part emulsified asphalt.

#### **5-02.3(8) PROGRESS OF WORK**

The Contractor shall organize the entire operation ensuring progression in an orderly and expeditious manner.

The sequence of operation for placing Bituminous Surface Treatments shall be as follows:

1. Apply asphalt emulsion on a properly prepared roadway surface resulting in a uniform application.
2. Apply Mineral Aggregate by spreader boxes or other means resulting in a uniform application.
3. Roll with pneumatic-tired and/or self-propelled smooth-wheeled roller.
4. Allow a minimum of 48 hours set time.
5. Sweep with an approved road broom to pick up and remove excess Mineral Aggregate. This work shall be accomplished in the early morning hours before the heat from the sun has warmed the pavement.
6. Maintain roadway surface for 5 calendar Days by sweeping and patching as necessary on a daily basis, maintaining traffic signing, etc.

Ten (10) Calendar Days after the final application, the Contractor shall make a final sweep with a mechanical broom, using the pick up broom only, to clear off any remaining loose aggregates. Gutter brooms shall not be used. The Contractor shall dispose of the excess Mineral Aggregates.

#### **5-02.3(9) PROTECTION OF STRUCTURES**

All handrails, guardrails, curbs, road signs, and other facilities shall be protected from splashing and overspray.

**5-02.3(10) UNFAVORABLE WEATHER**

Asphalt shall not be applied to excessively wet Material. Asphalt shall not be applied during rainfall, sand or dust storms, or before any imminent storms that might adversely impact the construction. The Engineer will determine whether the surface and Materials are acceptable for the construction in inclement weather.

The application of any asphalt to the roadway shall be restricted to the following conditions:

1. The roadway surface temperature shall be at least 60°F and the air temperature at least 60°F and either holding or rising, or
2. The air temperature shall be not less than 70°F when falling and the wind shall be less than 10 miles per hour as estimated by the Engineer.

No asphalt shall be applied which cannot be covered one hour before darkness. The Engineer may require the Contractor to delay application of asphalt until the atmospheric and roadway conditions are within the conditions listed above.

Construction of bituminous surface treatments on any Traveled Way shall not be carried out before May 15 or after September 1 of any year except upon Written Notice from the Engineer.

**5-02.3(11) ANTI-STRIPPING ADDITIVE**

When directed by the Engineer, an anti-stripping additive shall be added to the asphalt Material (see Section 9-02.4).

**5-02.3(12) UNTREATED ROADWAY SURFACES**

Existing crushed rock, gravel, and oil mat streets shall be restored with Mineral Aggregate Type 1, to a compacted depth of 4 inches. Final surfacing shall be constructed as specified in Section 5-04.3(5)C2.

**5-02.4 MEASUREMENT**

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for "Asphalt (Grade)" will be made by the gallon or ton before dilution.

Measurement for Mineral Aggregate Type will be by the ton.

**5-02.5 PAYMENT**

Compensation for the cost necessary to complete the work described in Section 5-02 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. "Asphalt, (Grade)", per gallon or ton.

The Bid item price for "Asphalt, (Grade)" shall include all costs for the work required to construct a single or multiple course bituminous surface treatment.

2. **Other payment information.**

Payment for Mineral Aggregate (Type) will be made in accordance with Section 4-01.5.

Change in Mineral Aggregate Type, or in grade of asphalt, or in Engineer directed application of fog seal will be addressed in accordance with Section 1-04.4.

All costs for the work required to coat omissions or to patch defects shall be included in the Bid item price for the applicable Bid item.

All costs for splashing and overspray protection shall be included in the Bid item price for the applicable Bid item.

All costs for roadway preparation will be paid in accordance with Section 5-04.5.

All costs for water will be paid in accordance with Section 2-07.5.

**SECTION 5-03 RESERVED****SECTION 5-04 ASPHALT CONCRETE PAVEMENT****5-04.1 DESCRIPTION**

Section 5-04 describes work consisting of one or more courses of plant mixed asphalt concrete placed on a prepared foundation or base in conformity with the lines, grades, thicknesses, and typical cross-sections shown on the Drawings.

Asphalt concrete shall be composed of asphalt and Mineral Aggregate which, with or without the addition of mineral filler and blending sand as may be required in the Contract, shall be mixed in the proportions specified to provide a homogeneous, stable and workable mixture.

Asphalt concrete Class A, Class B, Class D, Class F and Class G are designated as leveling or wearing courses. Asphalt concrete Class E is designated as a pavement Base Course. With the exception of asphalt concrete Class D, all mixtures are considered dense graded asphalt concrete.

**5-04.2 MATERIALS**

Materials shall meet the requirements of the following Sections:

Asphalt , Anti-Stripping Additive, Rejuvenating (Recycling) Agent	9-02
Mineral Aggregates	9-03
Temporary Pavement Marking	9-29.4

The various Mineral Aggregate Materials may be furnished in whole or in part by the Owner for the manufacture of asphalt concrete, or the Contractor may be required to furnish them. If any of these Mineral Aggregate Materials are not provided by the Owner, it shall be understood that the Contractor shall furnish such mineral Materials in the amounts required for the designated mix. Mineral Materials include coarse and fine aggregates, blending sand, and mineral filler.

Upon approval of the Engineer, the Contractor may have the option of utilizing asphalt concrete removed under the Contract, if any, or old asphalt concrete from an existing stockpile, or supplying all new Materials in the production of the asphalt concrete pavement, or any combination of the foregoing. If removed from an existing stockpile, the old asphalt concrete used shall be uniform in gradation, asphalt content, and asphalt viscosity. If not from an identified and approved source, the Mineral Aggregates shall meet degradation and hardness requirements. Should the Contractor elect to use 20 percent or less of recycled Materials, the recycled Materials need not be uniform as long as the asphalt concrete meets the Specifications for the class specified. Recycled Materials shall not be used in asphalt concrete Class D.

When Mineral Aggregate or a source for the production of Mineral Aggregate is provided by the Owner, the approximate percentage of asphalt required in the mixture for the particular class of pavement will be set forth in the Contract. The percentage is based upon a midline gradation mix design for the source provided.

The grade of asphalt for tack coats shall be Cationic Emulsified Asphalt CRS-2 or STE-1 (see Section 9-02.1(6)).

The grade of asphalt for sealing joints and other meet lines shall be STE-1. Asphalt for crack sealing shall be as specified in Section 5-04.3(5)D.

Production of Mineral Aggregate shall comply with the requirements of Section 3-01.

Unless otherwise specified in the Contract, asphalt concrete pavement shall be Asphalt Concrete Class A installed in 2 equal lifts to a total compacted thickness of 3 inches. Each asphalt concrete lift thickness shall be no less than 1-1/4 inch.

Asphalt for temporary pavement patch shall be MC-250 (see Section 9-02). Mineral Aggregate used in MC-250 asphalt mix shall meet the same requirements as the Mineral Aggregate used in Asphalt Concrete Class A.

See Section 4-04.2 for base course Mineral Aggregate limitations.

### **5-04.3 CONSTRUCTION REQUIREMENTS**

#### **5-04.3(1) ASPHALT MIXING PLANT**

Sufficient storage space shall be provided for each size of aggregate. The different aggregate sizes shall be kept separated until they have been delivered to the cold elevator feeding the plant except that aggregate combined with recycled aggregate meeting the requirements of Section 9-03.8(3)B need not be separated. The storage yard shall be maintained neat and orderly and the separate stockpiles shall be readily accessible for sampling.

Plants used for the preparation of asphalt concrete shall conform to all requirements of Section 5-04.3(1)A except that scale requirements shall apply only where weight proportioning is used. In addition, batch plants shall conform to the requirements of Section 5-04.3(1)B; continuous mix plants shall conform to the requirements of Section 5-04.3(1)C; and rotary drum plants shall conform to the requirements of Section 5-04.3(1)D.

#### **5-04.3(1)A REQUIREMENTS FOR ALL PLANTS**

Except as noted in Section 5-04.3(1)E, all plants shall meet the following requirements:

**1. The asphalt plant shall have a minimum capacity rating by the manufacturer as follows:**

For Projects involving 5,000 tons or more:

Batch plants — 2,000 lbs. per batch.

Continuous mix and rotary drum plants — 100 tons per hour.

For Projects involving less than 5,000 tons:

Batch plants — 1,000 lbs. per batch.

Continuous mix and rotary drum plants — 45 tons per hour.

**2. Pollution.** When the asphalt plant is erected at a site for the primary purpose of producing mixtures for a specific Project, pollution control shall be in accordance with Sections 1-07 and 8-01. The Contractor shall install supplemental Equipment, as necessary, to control pollution.

**3. Scales.** Plant and truck scales and weighing Equipment shall meet the requirements of Section 1-09.2.

**4. Equipment for preparation of asphalt Material.** Tanks for the storage of asphalt Material shall be equipped to heat and hold the Material at the required temperatures. The heating shall be accomplished by steam coils, electricity, or other acceptable means so that no flame shall be in contact with the tank. The circulating system for the asphalt Material shall be designed to ensure proper and continuous circulation during the operating period. Provision shall be made for measuring the asphalt in the storage tank and a valve shall be placed in either the supply line to the mixer or the storage tank for sampling the Material.

**5. Feeder for drier or drum mixer.** The plant shall be provided with accurate mechanical means for uniformly feeding the aggregate into the drier so that uniform production and uniform temperature are maintained. The feeder for blending sand, when required, shall be capable of providing a consistent, uniform flow in the amount designated by the Engineer.

**6. Screens.** Plant screens, capable of screening all aggregate to the specified sizes and proportions and having normal capacities in excess of the full capacity of the mixer, shall be provided.

**7. Bins.** The plant shall include storage bins of sufficient capacity to supply the mixer when it is operating at full capacity. Bins shall be arranged to ensure separate and adequate storage of appropriate fractions of the aggregate. Separate dry storage shall be provided for mineral filler when used and the plant shall be equipped to feed such Material into the mixer. Each bin shall be provided with overflow pipes, sized and

- located to prevent Material backing up into other compartments or bins. Each compartment shall be provided with an outlet gate, constructed so there shall be no leakage when closed. The gates shall close quickly and completely. Bins shall be constructed so samples can be readily obtained. Bins shall be equipped with adequate tell-tale devices to indicate the level of the aggregate in the bins at the lower quarter points.
8. **Asphalt control unit.** Acceptable means, either by weighing or metering, shall be provided to obtain the proper amount of asphalt Material in the mix. Means shall be provided for checking the quantity or rate of flow of asphalt Material into the mixer.  
 The asphalt may also be proportioned by a device which sprays the asphalt into the mixer through six or more nozzles, and which weighs or proportions the Material for each batch by a positive rotating meter which is calibrated in pounds. The metering device shall have an established background of service and shall be approved by the Engineer.
  9. **Thermometric Equipment.** An armored thermometer of adequate range in temperature reading shall be fixed in the asphalt feed line at a suitable location near the charging valve at the mixer unit.  
 The plant shall also be equipped with either an approved dial-scale, a mercury actuated thermometer, an electric pyrometer, or other acceptable thermometric instrument placed at the discharge chute of the drier to automatically register or indicate the temperature of the heated aggregate. This device shall be in full view of the plant operator. The Engineer may require replacement of any thermometer with an acceptable temperature-recording apparatus for better regulation of the temperature of aggregate.
  10. **Dust collector.** The plant shall be equipped with a dust collector constructed to waste or return uniformly to the hot elevator all or any part of the Material collected.  
 When a baghouse is used for dust control, the Contractor shall be able to introduce the Material returned from the baghouse into the mixture at a uniform and continuous rate. Accurate mechanical means shall be provided for uniformly feeding the fines into the aggregate stream. To accomplish this, the Contractor shall provide a surge hopper with a holding capacity sufficient to accumulate the baghouse fines or shall have a variable speed mechanical feed interlocked to the plant which prevents any variance in feed into the aggregate stream. Either method shall provide uniform and continuous return of the well-graded fine Materials and be provided with a method of withdrawing the surplus fines independently for disposal.
  11. **Burner fuel.** The plant burner fuel shall be restricted to the use of propane, butane, natural gas, methane, coal, No. 1 or No. 2 fuel oil, or other acceptable burner fuel submitted to and approved by the Engineer.

#### 5-04.3(1)B REQUIREMENTS FOR BATCH PLANTS

In addition to the requirements listed under Section 5-04.3(1)A, batch plants shall meet the following requirements:

1. The plant shall include a drier or driers which continuously agitate the aggregate during the heating and drying process, and be capable of preparing aggregates to specification requirements.
2. **Weigh box or hopper.** The Equipment shall include a means for accurately weighing each size of aggregate in a weigh box or hopper suspended on scales and of ample size to hold a full batch without hand raking or running over. The gate shall close tightly so that no Material is allowed to leak into the mixer while a batch is being weighed.
3. **Asphalt control.** The Equipment used to measure the asphalt Material shall be accurate to plus or minus 0.5 percent. The asphalt bucket shall be a nontilting type with a loose sheet metal cover. The length of the discharge opening or spray bar shall be not less than 75 percent of the length of the mixer and it shall discharge directly into the mixer. The asphalt bucket, its discharge valve or valves and spray bar shall be adequately heated. Steam jackets, if used, shall be efficiently drained and all connections shall be constructed so they do not interfere with the efficient operation of the asphalt scales. The capacity of the asphalt bucket shall be at least 15 percent in excess of the weight of asphalt Material required in any batch. The plant shall have an adequately heated quick-acting, nondrip, charging valve located directly over the asphalt Material bucket.  
 The indicator dial shall have a capacity of at least 15 percent in excess of the quantity of asphalt Material used in a batch. The controls shall be constructed so they may be locked at any dial setting and automatically reset to that reading after the addition of asphalt Material to each batch. The dial shall be in full view of the mixer operator. The flow of asphalt Material shall be automatically controlled so it will begin when the dry mixing period is over. All of the asphalt Material required for one batch shall be discharged in not more than 15 seconds after the flow has started. The size and spacing of the spray bar openings shall provide a uniform application of asphalt Material the full length of the mixer. The section of the asphalt line between the charging valve and the spray bar shall be provided with a valve and outlet for checking the meter when a metering device is substituted for an asphalt Material bucket.
4. **Mixer.** The batch mixer shall be an acceptable type capable of producing a uniform mixture meeting the requirements of these Specifications. If not enclosed, the mixer box shall be equipped with a dust hood to prevent loss of dust.  
 Clearance of the blades from all fixed and moving parts shall not exceed 1 inch unless the maximum diameter of the aggregate in the mix exceeds 1-1/2 inches, in which case the clearance shall not exceed 1-1/2 inches.
5. **Mixing time.** The plant shall be capable of regulation of the mixing time as specified in Section 5-04.3(8) in 5 second increments.

6. **Automatic controls.** All Projects using a batch mixer involving 5,000 tons or more of asphalt concrete shall conform to the following provisions. Automatic control of batch mixing operations may be used providing the requirements of this Section are met.

The proportioning and timing devices shall be automatic to the extent that the only manual operation required for the proportioning and mixing of Materials for one batch shall be a single operation of a switch or starter.

The mixing plant shall be equipped with automatic weight proportioning devices to monitor and control the weights of the several components of aggregates and of the asphalt, plus timing lock devices to monitor and control the position of the aggregate weigh hopper dump gate, the asphalt bucket discharge valve, and the mixer discharge gate.

Withdrawal from the aggregate bins and the discharge of the weigh hopper shall be so interlocked that the weigh hopper cannot discharge until the required quantity of aggregate from each bin has been deposited therein. The weigh hopper may be a single compartment, individual weight control type, or of the divided compartment, preset volume type. When the single compartment, individual weight control type is used, the automatic scale weight system shall discharge and weigh Material from one bin at a time. When the preset volume weigh hopper is used, the automatic control system shall check the total weight of each aggregate batch and provision shall be made to allow the Engineer to check easily and quickly the individual aggregate weights at any time.

The timing lock devices shall be actuated by the opening of the aggregate weigh hopper dump gate. They shall lock the asphalt bucket discharge valve until preset dry mixing time is expired and shall lock the mixer discharge gate throughout the preset dry and wet mixing periods. The control of the timing shall be flexible and capable of being set at intervals of not more than 5 seconds throughout cycles up to 60 seconds.

The dials of the timing locks and automatic weighing controls shall be so arranged that the time interval and mass proportion controls may be locked by the Engineer.

#### 5-04.3(1)C REQUIREMENTS FOR CONTINUOUS MIX PLANTS

In addition to the requirements listed under Section 5-04.3(1)A, continuous mix plants shall meet the following requirements:

1. **Aggregate proportioning.** The plant shall include a means for accurately proportioning each size of aggregate.  
The plant shall have a feeder mounted under each compartment bin. Each compartment bin shall have an accurately controlled individual gate to form an orifice for volumetrically measuring the Material drawn from each compartment. The feeding orifice shall be rectangular with one dimension adjustable by positive mechanical means provided with a lock.  
Indicators shall be provided for each gate to show the respective gate opening in inches. The feeder belt or drive system shall be adjustable to various speeds and calibrated with various gate openings for the Material to be used.
2. **Weight calibration of aggregate feed.** The plant shall include a means for calibration of gate openings by weighing test samples. Provision shall be made so that Materials fed out of individual orifices may be bypassed to individual test boxes. The plant shall be equipped to conveniently handle individual test samples weighing not less than 200 pounds.
3. **Synchronization of aggregate feed and asphalt Material feed.** Acceptable means shall be provided to afford positive interlocking control between the flow of aggregate from the bins and the flow of asphalt Material from the meter or other proportioning device. This control shall be accomplished by interlocking mechanical means or by any other positive method acceptable to the Engineer.  
A warning device shall be provided to alert the plant operator any time the level of material in any one bin is so low that uniform feed is discontinued.
4. **Mixer.** The plant shall include a continuous mixer of an acceptable type, adequately heated and capable of producing a uniform mixture meeting the requirements of these Specifications. It shall be equipped with a discharge hopper with dump gates which permit rapid and complete discharge of the mixture. The paddles shall be adjustable for angular position on the shafts and reversible to retard the flow of the mix. The mixer shall have a manufacturer's plate giving the net volumetric contents of the mixer at the several heights inscribed on a permanent gauge. Charts shall be provided showing the rate of feed of aggregate per minute for the aggregate being used.

#### 5-04.3(1)D REQUIREMENTS FOR ROTARY DRUM PLANTS

In addition to the requirements listed under Section 5-04.3(1)A, rotary drum plants shall meet the following requirements:

1. The plant shall have a feeder capable of uniformly introducing the aggregate into the drum. The aggregate feeder shall be synchronized with the asphalt Material feed. Acceptable means shall be provided to afford positive interlocking control between each aggregate cold feed bin, aggregate feed, and the asphalt feed so the plant automatically activates a warning device if the feed of either aggregate or asphalt is interrupted.
2. The plant shall have the mixing capability to provide a uniform mixture meeting the requirements of these Specifications.
3. The asphalt Material feed shall have positive recording capabilities so the amount of asphalt incorporated into the mix during any given period of time may be read directly.



**5-04.3(1)E SCREENLESS PLANTS**

If the Contractor elects to produce aggregate in accordance with Section 9-03.8(3)B, then Item 6 — Screens and Item 7 — Bins of Section 5-04.3(1)A will not be required provided the completed mixture meets the Specifications as listed in Section 9-03.8(6) for the class of mix being produced.

**5-04.3(2) HAULING EQUIPMENT**

Trucks used for hauling asphalt concrete mixtures shall have tight, clean, smooth metal beds that have been thinly coated with a minimum amount of paraffin oil, or other acceptable material to prevent the mixture from adhering to the beds. Each truck shall have a cover of canvas or other suitable material of sufficient size to protect the mixture from the weather.

When dump truck beds are sprayed with oil, the excess oil shall be drained prior to filling with the asphalt mixture. For hopper trucks, the conveyer shall be in operation during the process of oiling the bed.

Unless specified otherwise in the Contract, the asphalt concrete mixture shall leave the mixing plant at a temperature between 260°F and 350°F, and when deposited as part of the Pavement Structure, shall have a minimum temperature of 250°F.

**5-04.3(3) RESERVED****5-04.3(4) ASPHALT EQUIPMENT****5-04.3(4)A ASPHALT PAVERS**

Asphalt pavers shall be self-contained, power-propelled units, provided with an activated screed or strike-off assembly, heated if necessary, and capable of spreading and finishing courses of asphalt plant mix Material in lane widths applicable to the specified typical section and thicknesses shown on the Drawings.

The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, segregating, or gouging the mixture. Any bolt-on or hydraulic extensions shall produce the same results including ride, density, and surface texture as the screed or strike off assembly. Hydraulic extenders without screeds, augers, and vibration shall not be used in the Traveled Way.

When laying mixtures, the paver shall be operated at a uniform forward speed consistent with the plant production rate and roller train capacity to result in a continuous operation. The auger speed and flight gate opening shall be adjusted to coordinate with the operation.

The paver shall be equipped with automatic screed controls with sensors for either or both sides of the paver. The controls shall be capable of sensing grade from an outside reference line, sensing the transverse slope of the screed, and providing automatic signals which operate the screed to maintain the desired grade and transverse slope. The sensor shall be constructed so it operates from a reference line or a multi-footed ski-like arrangement.

The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent. The paver shall be equipped with automatic feeder controls, properly adjusted to maintain a uniform depth of material ahead of the screed.

Manual operation will be permitted in the construction of irregularly shaped and minor areas. These areas may include, but are not limited to, gore areas, road approaches, left-turn channelizations, and tapers.

When specified in the Contract, reference lines will be required for both outer edges of the Traveled Way for each main line roadway for vertical control. Horizontal control utilizing the reference line will be permitted. The grade and slope for intermediate lanes shall be controlled automatically from reference lines or by means of a multi-footed ski and a slope control device. When the finish of the grade prepared for paving is superior to the established tolerances, and, when in the opinion of the Engineer, further improvement to the line, grade, cross-section, and smoothness can best be achieved without the use of the reference line, a multi-footed ski-like arrangement may be substituted subject to the continued approval of the Engineer. After paving the first lane, a joint matcher may be used subject to the approval of the Engineer. The use of the reference line shall be reinstituted immediately whenever the Contractor fails to maintain a superior pavement, or rhythmic undulations occur, or the surface smoothness of the course being paved fails to meet the requirements for wearing course. The reference line may be removed after the completion of the first course of asphalt concrete if the Contractor demonstrates acceptable thickness and finished surface control. Failure to continue acceptable thickness and finished grade control may require reinstallation of the reference line at the Contractor's sole expense.

The Contractor shall furnish and install all pins, brackets, tensioning devices, wire, and accessories necessary for acceptable operation of the automatic control Equipment. The Contractor shall submit samples of the above items along with the methods and procedures to the Engineer for approval at least 5 Working Days prior to installation.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing Equipment impractical, the paving may be done with other Equipment or by hand.

**5-04.3(4)B ROLLERS**

Rollers shall be of the steel wheel, vibratory, or pneumatic tire type, in good condition, capable of reversing without backlash, and shall be operated at speeds slow enough to avoid displacement of the mixture. The number and weight of rollers shall be sufficient to compact the mixture as required in Section 5-04.3(10). The use of Equipment which results in excessive crushing of the aggregate will not be permitted. Rollers producing pickup, washboard, uneven compaction of the surface or other undesirable results will be rejected by the Engineer.

The following shall apply to the various types of rollers:

**1. Vibratory Rollers**

- a. A variable amplitude will be required, with at least 2 settings.
  - b. A variable frequency with a 2,000 VPM minimum.
  - c. The maximum rate of travel under vibration shall be limited to 3 mph.
  - d. Pneumatic propulsion on Surface Courses shall be limited to smooth tires that do not leave visible tracks.
- 2. Pneumatic Tired Rollers**
- a. The maximum rate of travel shall be limited to 5 mph.
  - b. Skirts shall be firmly affixed to the perimeter of the roller and shall uniformly extend to within 1 inch of the pavement surface.
- 3. Steel Wheel Rollers**
- a. The maximum rate of travel shall be limited to 4 mph.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing Equipment impractical, the paving may be done with other Equipment or by hand.

#### **5-04.3(4)C PLANERS**

Planing shall be by the cold planing method only. Equipment shall be of a type that has operated successfully on work comparable to that in the Contract and shall be subject to the Engineer's approval prior to use. Equipment shall be maintained in good working condition while in use. The storage of Equipment and volatile Material shall be off-street and in compliance with Seattle Fire Department regulations.

Cold planers shall be milling type Equipment capable of cutting at least a 5 foot chord to a depth of 4 inches in one pass. Smaller planers may be used for cutting around utility castings and making taper cuts for butt joints.

For mainline cold planing operations, the Equipment shall have automatic controls with sensor for either or both sides of the Equipment capable of sensing the proper grade from an outside reference line. The automatic controls shall also be capable of maintaining the desired transverse slope. The sensor shall be so constructed that it operates from a reference line or multi-footed ski-like arrangement. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent.

On areas where irregularities or unavoidable obstacles make the use of mechanical planing Equipment impractical, the planing may be done with other Equipment or by hand.

#### **5-04.3(4)D DISTRIBUTORS**

Distributors shall meet the requirements of Section 5-02.3(1).

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing Equipment impractical, the paving may be done with other Equipment or by hand.

#### **5-04.3(5) PREPARATION OF STREET SURFACES**

##### **5-04.3(5)A PREPARATION DESCRIPTION**

Street surfaces shall be classified as treated and untreated surfaces. Treated surfaces shall be cement concrete, asphalt concrete, brick, seal coat or other bituminous surface treatments. Untreated surfaces shall be crushed rock, gravel, or oil mat surfaces.

The work of preparing existing street surfaces prior to the addition of one or more courses of asphalt concrete or other bituminous Material shall be classified as "surface preparation" for treated street surfaces, and "roadway preparation" for untreated street surfaces.

##### **5-04.3(5)B SURFACE PREPARATION - TREATED SURFACES**

##### **5-04.3(5)B1 GENERAL**

When an existing treated surface is to be used as a base for one or more courses of new asphalt concrete or other surfacing, the treated surface shall first be swept, cleaned, and patched as follows:

- 1. Treated surfaces shall be swept with a power broom until free from dirt and other foreign matter. Hand brooms shall be used to clean omissions of the power broom. Fatty asphalt patches, grease drippings and other objectionable Material shall be removed from the existing pavement.
- 2. Excess asphalt joint filler shall be completely removed and premolded joint filler shall be removed to at least 1/2-inch below the surface of the existing pavement.
- 3. In order to obtain a base having uniform grade and cross section, all surface irregularities in the existing treated surface shall be corrected prior to placement of the new asphalt concrete or other bituminous surface treatment. Correction shall be by patching and if necessary, preleveling unless planing or heater-scarifying is specified. Although patching and preleveling may be necessary after planing, such work, after planing, shall be performed only when specified in the Contract or designated by the Engineer.

##### **5-04.3(5)B2 PRELEVELING**

When a surface of the existing pavement or old base is irregular, it shall be brought to a uniform grade and cross section by preleveling.

As soon as the existing surface has been thoroughly cleaned, holes and discontinuities in the surface and edges and edge breaks shall be patched. Asphalt used for patching shall be Class A Asphalt concrete mix, heated to the temperature specified in Section 5-04.3(6). Before placing the premixed patch Material in the hole, the bottom and edges of the hole shall be tack coated. The patch Material shall be thoroughly compacted.

Patching shall be accomplished prior to preleveling or installation of the first asphalt course, whichever is applicable. Preleveling of uneven or broken surfaces shall be accomplished by placing asphalt concrete of the class specified with a motor patrol grader, by hand-raking, by Miller box, or by such other method acceptable to the Engineer. After placement, the asphalt concrete shall be thoroughly compacted.

In some cases spot planing to remove high areas caused by rutting, etc., shall be performed prior to preleveling. Locations to be planed prior to preleveling will be indicated in the Contract.

Unless specified otherwise in the Contract, preleveling Materials shall be the same class of asphalt concrete as the wearing course except that when asphalt concrete Class G is being used to construct the wearing course overlay, asphalt concrete Class A or Class B may, upon approval of the Engineer, be used as an alternate for preleveling provided there is no increase in cost to the Owner for substituting one of the alternate mixes.

#### **5-04.3(5)B3 PLANING BITUMINOUS PAVEMENTS**

When planing is specified, the surface of designated pavements or the top surface of subsurface courses shall be removed or reshaped by planing to remove irregularities and produce a prepared subgrade acceptable for receiving an asphalt concrete overlay. Planing shall be by the cold milling method unless heater planing is otherwise specified in the Contract. The planer shall not be used on the final wearing course of new asphalt concrete construction.

Planing operations shall be conducted in a manner that do not tear, break, burn, or otherwise damage the surface which is to remain. The finished planed surface shall be slightly grooved or roughened and shall be free from gouges, deep grooves, ridges, or other imperfections.

A tapered wedge cut shall be made longitudinally along curb lines sufficient to provide a minimum of 4 inches of curb reveal after placement and compaction of the final wearing course. A tapered wedge cut shall also be made at transitions to adjoining pavement surfaces (meet lines) where butt joints are indicated on the Drawings. Butt joints shall be cut in a straight line with vertical faces 2 inches or more in height and shall produce a smooth transition to the existing adjoining pavement.

After planing is complete, the planed surfaces shall be swept, cleaned, and if required by the Contract, patched and preleveled.

When the planed street surface is opened to traffic prior to asphalt concrete paving operations, the Contractor shall install, maintain and subsequently remove temporary pavement markings as specified in Section 5-04.3(17).

Tapered sections of Temporary Asphalt (MC-250) shall be placed around each utility casting that protrudes more than 1 inch above the surface in the roadway, or any other area which may be a nuisance to traffic. These temporary tapered sections shall be removed prior to laying the asphalt overlay.

#### **5-04.3(5)B4 TACK COAT**

A tack coat of asphalt, applied at the rate of 0.02 to 0.08 gallons per square yard of retained asphalt, shall be applied by a mechanical distributor meeting the requirements of Section 5-02.3(1), to all surfaces on which any course of asphalt concrete is to be placed or abutted including prior to preleveling. The distributor Equipment shall be capable of distributing asphalt uniformly over an area in controlled amounts and shall be equipped with hand operated spray Equipment for use only on inaccessible and irregularly shaped areas. When asphalt concrete pavement Class D is being constructed, the tack coat shall be applied to the existing surface at a rate of 0.12 to 0.20 (0.08 to 0.12 residual) gallons per square yard.

Where the new asphalt concrete abuts a curb or gutter, cold pavement joint, trimmed meet line, or any metal surface, a thin tack coat of asphalt shall be applied on the vertical face of the abutting surface by hand painting prior to paving. The application on the contact surfaces shall be thin and uniform in order to avoid an accumulation of excess asphalt in puddles. The Contractor shall not apply the tack coat on vertical contact surfaces above the finished height of the asphalt concrete being placed.

Where it is necessary to remove sections of existing pavement, the removal shall comply with Section 2-02.

#### **5-04.3(5)C SURFACE PREPARATION OF UNTREATED SURFACES**

##### **5-04.3(5)C1 GENERAL**

Untreated roadway surfaces, including intersections and side roadway approaches which are to receive asphalt concrete pavement or other surfacing shall be shaped to a uniform grade and cross-section, conforming as nearly as possible to that which exists except:

1. When new lines and grades are indicated in the Contract or staked by the Engineer; or
2. Where the height of the centerline crown above the gutterline or edge of roadway, exceeds 2 percent of the distance of half the roadway width, then the crown and adjacent roadway shall be corrected by excavation, or scarifying and blading, to bring about a cross section having a revised crown height 2 percent of half the roadway width distance.

Lines and grades will not be set by the Engineer in item 2. immediately above. The basis for establishing final line and grade in such cases shall be curbs, curbs and gutters, existing pavement, or pavement edges or other existing street improvements. Existing driveways shall be graded as necessary to provide a smooth transition to the final grade of the new pavement surface including such grading as may be necessary to permit driveway adjustment with Class A Asphalt.

Where no curbs or curbs and gutters exist and where none are presently required, subgrade preparation shall extend one foot on each side of the roadway beyond the final asphalt paving width indicated on the Drawings or to such greater width as the Engineer may require. At street intersections the minimum radius of curve at edge of pavement shall be 20 feet.

The grade shall be shaped so that all frame castings for manholes, monument boxes, gate valve boxes, catch basins, etc. within the roadway section to be treated extend above the prepared surface, such that the casting is flush with the final

surface. Where existing asphalt or cement concrete pavement is being met with new asphalt surfacing, sufficient existing Material shall be removed to permit the forming of a butt joint. The end results shall be a smooth level roadway surface as specified in Section 5-04.3(13).

Those areas and surfaces which are to be prepared for the placement of asphalt concrete pavement or other surfacing shall be considered subgrade for the new construction. See Section 2-06 for subgrade preparation requirements. Excess native Material deemed suitable by the Engineer shall be stockpiled by the Contractor or bladed to the roadway edge and used as needed for fill or shoulder restoration following completion of the paving. The scarified or excavated Material shall be used to the fullest extent possible as sub-base Material prior to the placement of new crushed rock.

During the operation of blading and rolling, water shall be applied in the amount and at locations designated by the Engineer.

If there is a surplus of stockpiled Material after construction is complete, the Contractor shall clean up the stockpile site and remove and dispose of the surplus Material.

When, in the opinion of the Engineer, insufficient roadway subgrade Material is available, the Contractor shall furnish, place, and compact a maximum of 2 inches of Mineral Aggregate Type 1 on the subgrade. The Material shall not be placed unless specifically ordered in writing by the Engineer.

The Contractor shall insure that a 6 inch minimum depth of selected and suitable native Material, or procured crushed rock base acceptable to the Engineer is provided for the asphalt paving.

The full width of the roadway shall be sprinkled with water, when ordered by the Engineer, to alleviate dust and to keep the subgrade Material moist as an aid to compaction.

Immediately before the prime coat of asphalt is applied, the roadway surface shall be stable and unyielding, in dry to medium damp condition, free from irregularities and Material segregation, and true to line, grade, and cross section.

In the event the compacted aggregates are of such gradation as to resist penetration of the asphalt, the Contractor shall loosen no more than the upper 1/2 inch of surface and regrade it without compaction immediately before the prime coat application. Following the application of aggregate on the prime coat, rolling shall be performed as specified above.

#### **5-04.3(5)C2 PRIME COAT TREATMENT**

Unless otherwise specified in the Contract, a prime coat treatment of asphalt complying with the requirements of Section 5-02.3(3) for existing gravel, crushed rock, or oil mat streets shall be applied prior to paving with asphalt concrete.

The prime coat shall be applied over the entire area of proposed asphalt pavement construction, and asphalt concrete pavement shall not be placed until the prime coat has cured for a full 5 days.

The Contractor shall maintain the completed prime coat by blading or brooming until the asphalt concrete is placed. Should any holes, breaks, or irregularities develop in the roadway surface after the prime coat has been applied, they shall be patched or repaired in accordance with Section 5-04.3(5)C1 immediately in advance of placing the asphalt concrete pavement.

Immediately prior to tacking and placing the asphalt concrete pavement, the surface of the prime coat shall be swept clean of all dirt, dust, and other foreign matter.

In areas used as turnouts or which receive heavy service, the Engineer may order a change in the subgrade elevation to provide a greater depth of pavement.

The Contractor shall prepare untreated shoulders and traffic islands by blading and compacting to provide a sound base for paving. The prime coat treatment shall be omitted, and the asphalt concrete pavement shall be constructed on the prepared subgrade after tacking in accordance with Section 5-04.3(5)B4.

When prime coat treatment is not required, the Contractor shall prepare the untreated roadway as specified above except for the prime coat of asphalt and aggregate. The asphalt concrete pavement shall be constructed on the prepared subgrade and tacked in accordance with Section 5-04.3(5)B4.

#### **5-04.3(5)D CRACK SEALING**

When the Work requires "Crack Sealing", all cracks and joints shall be cleaned with a stiff-bristled broom and compressed air. After cleaning, all cracks less than 1/4 inch in width shall be filled with straight CSS-1 emulsified asphalt and topped with sand. All cracks and joints at least 1/4 inch and less than 3/4 inch in width shall be filled with either a sand slurry or rubberized asphalt. Cracks 3/4 inch and larger in width shall require preparation by routing prior to cleaning and then shall be filled with a sand slurry. Application of the sand slurry or rubberized asphalt shall be as follows:

1. **Sand Slurry:** The sand slurry shall consist of approximately 20 percent CSS-1 emulsified asphalt, approximately 2 percent Portland cement, water (if required), and the remainder clean U.S. no. 4 - 0 paving sand. The mixture shall be poured into the cracks and joints until full. The following Day, any cracks or joints which are not completely filled shall be topped off with the slurry. After sealing, the filler shall be broomed or squeegeed flush with the existing pavement surface and allowed to cure prior to constructing the asphalt concrete overlay.
2. **Rubberized Asphalt:** The sealant Material shall meet the requirements of Section 9-04.10 and shall be applied in accordance with the manufacturer's recommendations. These recommendations shall be submitted to the Engineer by the Contractor prior to the start of this type construction and shall include recommended heating time and temperature, allowable storage time and temperatures after initial heating, allowable reheating criteria, and application temperature range. The cracks shall be completely dry before being filled with the rubberized asphalt. Filling shall be controlled to confine the Material within the crack or joint. If, in the opinion of the Engineer, the Contractor's method of filling results in an excessive amount of

sealant on the pavement surface, filling shall be stopped and the method changed. Any overflow shall be cleaned from the pavement surface.

#### **5-04.3(6) HEATING OF ASPHALT MATERIAL**

The asphalt shall be heated to a maximum of 350°F. The asphalt shall be heated in a manner that avoids local overheating and provide a continuous supply of asphalt Material to the mixer at a uniform temperature plus or minus 25°F from the temperature specified.

#### **5-04.3(7) PREPARATION OF AGGREGATES**

##### **5-04.3(7)A GENERAL**

The aggregates shall be stockpiled according to the requirements of Section 9-03.8(3). The aggregates shall be removed from stockpile(s) in a manner to ensure a minimum of segregation when being moved to the asphalt plant for processing into the final mixture.

##### **5-04.3(7)B MIX DESIGN**

Once the crushing operation has stabilized, a representative sample will be obtained from the stockpiled aggregates. A sample of the stockpiled blending sand, if needed, will also be required at this time. The Contractor shall submit for approval at least 15 Working Days in advance a production mix gradation which shall be the basis for the job mix formula for the mix design. The proposed gradation may vary from the production values from aggregate production to reflect anticipated plant operations and adjustments as necessary to ensure compatibility. Paving operations shall not proceed until a mix design is approved by the Engineer. The Contractor's submittal shall also include a mix design from an ASTM or AASHTO accredited test laboratory approved by the Engineer based on the requirements of Section 9-03.8(2). Additional time will be required, and a separate mix design submittal required, if the Contractor has requested that more than one source of asphalt cement be approved.

When old asphalt concrete is proposed for inclusion in the mix, the Contractor shall submit a design for approval, including representative samples taken in the presence of the Engineer, and the approximate proportions of the various Materials (old asphalt concrete, new aggregate, recycling agent, new paving asphalt) to be used. Upon tentative approval of the approximate proportions proposed by the Contractor, the Materials shall be proportioned together for a job mix design. Approval of the mix design will be based upon meeting the requirements of Section 9-03.8(2) for the specified class of asphalt concrete, unless indicated otherwise in the Contract. In addition, for mix design approval, the blend of recovered paving asphalt plus recycling agent and additional paving asphalt shall meet the requirements for PG 64-22. The Contractor shall allow 15 Working Days for approval of this design beginning when the Material has been received by the SPU Materials Laboratory. Additional time may be required if the mix design is found unacceptable, or if the Contractor requests more than one recycling agent or paving asphalt source approval. The Contractor is also advised that production of the asphalt concrete shall not commence until the job mix design has been established and approved.

The Contractor shall obtain the Engineer's approval prior to changing the source of asphalt cement during the production of asphalt concrete as specified above. Blending of asphalt from different sources will not be permitted.

#### **5-04.3(8) MIXING**

The prepared aggregates shall be combined in the mixer in the amount of each fraction of aggregates as specified. The asphalt Material shall be measured or gauged and introduced into the mixer per the approved mix design submittal.

After the required amounts of aggregate and asphalt Material have been introduced into the mixer, unless the Contract specifies otherwise, the Materials shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the asphalt Material throughout the aggregate is ensured. When discharged, the temperature of the mix shall not exceed 325°F except that the temperature for mixes designed for asphalt concrete Class D shall not exceed 260°F. A maximum water content of 2 percent in the mix, at discharge, will be allowed providing the water causes no problems with handling, stripping, or flushing. Storing or holding of the asphalt concrete mixture in acceptable storage facilities will be permitted during the daily operation but in no event shall the Materials be held for more than 24 hours. Materials held for more than 24 hours after mixing shall be rejected and disposed of by the Contractor at no expense to the Owner. The storage facility shall have a visible device located at the top of the cone or about the third point to indicate the amount of Material in storage. No Material shall be accepted from the storage facility when the Material in storage is below the top of the cone of the storage facility, except at the end of the Working Day.

#### **5-04.3(9) SPREADING AND FINISHING**

##### **5-04.3(9)A GENERAL**

The asphalt concrete mixture shall be laid at a temperature of not less than 250°F and not less than the asphalt pavement manufacturer's recommended temperature whichever is greater, upon an approved surface, then spread and struck off to the grade and elevation established. Asphalt pavers complying with Section 5-04.3(4)A shall be used to distribute the mixture. Unless the Contract specifies otherwise, the nominal compacted depth of any layer of any asphalt course shall not exceed the following depths:

Class of Asphalt Concrete	Depth
E	0.35 foot
A & B when used for Base Course	0.35 foot
A, B, & F	0.25 foot
G	0.10 foot
D	0.08 foot

In all cases in the table above, the minimum compacted thickness of any layer of any class asphalt shall not be less than 1.5 times the maximum aggregate size for the class of asphalt.

When more than 1 course is necessary to meet the final paving grade, the first course shall include any widening of the existing roadway and preleveling of the existing pavement surface. The preleveling course or courses shall be constructed so that the final wearing course has a uniform compacted depth and conforms to the finished grade and cross section elevations specified.

Construction of 1 course upon another shall not proceed until the underlying course has completely cooled and set.

No hauling shall be done over freshly placed pavement.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing Equipment impractical, the paving may be done with other Equipment or by hand.

The placing of asphalt mixtures at night will not be permitted.

When the asphalt mixture is being produced by more than one asphalt plant, the Material produced by each plant shall be placed by separate spreading and compacting Equipment.

The internal temperature of the mix should not be less than 185°F upon achieving density requirements in accordance with the applicable Specifications. Should the Contractor not achieve specification densities at temperatures of 185°F or above 185°F, the Contractor will be permitted to continue to compact with steel wheeled rollers or a pneumatic tired roller provided that future compaction operations are adjusted to meet the density requirements at the aforementioned temperature. The vibratory roller, in the vibratory mode, shall not be used under any circumstances whenever the internal temperature of the mixture is below 175°F.

#### **5-04.3(9)B UTILITY ADJUSTMENTS**

Utility castings shall be adjusted to finished grade prior to the construction of the final wearing course (Section 7-20).

#### **5-04.3(10) COMPACTION**

##### **5-04.3(10)A GENERAL**

Immediately after the asphalt concrete mixture has been spread, struck off, and surface irregularities adjusted, it shall be thoroughly and uniformly compacted. The completed course shall be free from ridges, ruts, humps, depressions, objectionable marks, or irregularities and in conformance with the line, grade, and cross-section shown on the Drawings, or as established by the Engineer. If necessary, the mix design may be altered to achieve desired results.

Compaction shall take place when the mixture is in the proper condition so that no undue displacement, cracking, or shoving occurs. All compaction Equipment shall be operated to produce the required compaction. Areas inaccessible to large compaction Equipment shall be compacted by mechanical or hand tampers. Any asphalt concrete that becomes loose, broken, contaminated, shows an excess or deficiency of asphalt, or is in any way defective, shall be removed and replaced at no additional cost with fresh hot mix which shall be immediately compacted to conform with the surrounding area.

The type of rollers to be used and their relative position in the compaction sequence shall generally be the Contractor's option, provided specification densities are attained. An exception shall be that the pneumatic tired roller shall be used between October 1 and April 1. Coverages with a vibratory or steel wheel roller may precede pneumatic tired rolling. When asphalt concrete pavement Class D is being constructed, the use of pneumatic rollers will not be required.

Vibratory rollers shall not be operated in the vibratory mode when the internal temperature of the mix is less than 175°F or when checking or cracking of the mat occurs at a greater temperature. Vibratory rollers in the vibratory mode are also prohibited on bridge decks, brick bases, and block bases.

Where hand tamping of new asphalt is required, the Contractor shall use a flat bottomed tool weighing a minimum of 40 pounds.

#### **5-04.3(10)B CONTROL**

For asphalt concrete Class A, Class B, Class E and Class F, where paving is in the traffic lanes, including lanes for ramps, truck climbing, weaving, speed changes, and left turn channelization, and the specified compacted course thickness is greater than 0.10 foot, the acceptable level of compaction shall be a minimum of 91 percent of the maximum density as determined by AASHTO T 209. The level of compaction attained will be determined as the average of not less than 5 nuclear density gauge tests taken on the Day the mix is placed (after completion of the finish rolling) at randomly selected locations within each lot. The quantity represented by each lot will be no greater than a single Day's production or approximately 400 tons, whichever is less.

Control lots not meeting the prescribed minimum density standard shall be removed and replaced.

Cores may be used as an alternate to the nuclear density gauge tests. When cores are taken by the Engineer at the request of the Contractor, the request shall be made by noon of the first Working Day following placement of the mix.

At the start of paving, if requested by the Contractor, a compactability test section shall be constructed to determine the compactability of the mix design. Compactability shall be based on the ability of the mix to attain the specified minimum density (91 percent of the maximum density determined by WSDOT Test Method 705). Following determination of compactability, the Contractor is responsible for the control of the compaction effort. If the Contractor does not request a test section, the mix will be considered compactable.

Asphalt Concrete Class A, Class B, Class E and Class F, constructed under conditions other than listed above shall be compacted on the basis of a test point evaluation of the compaction train. The test point evaluation shall be performed in accordance with instructions from the Engineer. The number of passes with an approved compaction train, required to attain the maximum test point density, shall be used on all subsequent paving.

Asphalt concrete Class D and preleveling mix shall be compacted to specified requirements.

In addition to the randomly selected locations for tests of the control lot, the Engineer reserves the right to test any area which appears defective and to require the further compaction of areas that fall below acceptable density readings. These additional tests shall not impact the compaction evaluation of the entire control lot.

#### **5-04.3(11) JOINTS**

##### **5-04.3(11)A LONGITUDINAL AND TRANSVERSE JOINTS**

The placing of the top or wearing course shall be as nearly continuous as possible, and the roller shall pass over the unprotected end of the freshly laid mixture only when the laying of the course is discontinued for such length of time as to permit the mixture to become chilled. When this work is resumed, the previously compacted mixture shall be cut back to produce a slightly beveled edge for the full thickness of the course.

Where a transverse joint is being made in the wearing course, strips of heavy wrapping paper shall be used. The wrapping paper shall be removed and the joint trimmed to a slightly beveled edge for the full thickness of the course prior to resumption of paving.

The Material which is cut away shall be wasted and new mix shall be laid against the fresh cut. Rollers or tamping irons shall be used to seal the joint.

The longitudinal joint in any one layer shall be offset from the layer immediately below by not more than 6 inches nor less than 2 inches. All longitudinal joints constructed in the top layer shall be at a lane line or edge line of the traveled way. However, on one-lane ramps a longitudinal joint may be constructed at the center of the traffic lane, subject to approval by the Engineer, if:

1. The ramp must remain open to traffic, or,
2. The ramp is closed to traffic and a hot lap joint is constructed.

If a hot lap joint is allowed, two paving machines shall be used; a minimum average compacted density of 92 percent of the maximum density shall be achieved throughout the traffic lane; and construction Equipment shall not impact any uncompacted mix.

Immediately following the compaction of the top wearing course, meet line joints where the new asphalt concrete abuts existing asphalt concrete pavements, Portland cement concrete pavements, oil mats, concrete curbs and gutter, etc., shall be sealed with STE-1 asphalt per Section 5-04.3(11)B.

##### **5-04.3(11)B CONNECTIONS WITH EXISTING FACILITIES**

Where construction of new asphalt concrete pavement connects with an existing roadway surface, driveway, bridge, railway crossing, or other similar facility, the Contractor shall provide a smooth riding transition between the new and existing surface. Such work may require the modification of the existing roadway profile by burning, planing or milling in order to achieve the desired smooth riding transition or may require other adjustment of the connecting surface.

Where butt joints are required at the meet lines of new construction and existing surfaces, the existing abutting pavement shall be trimmed by chipping, planing, milling or such other acceptable method in order to insure a minimum depth of 2 inches of compacted asphalt concrete at the point of connection. Meet lines shall be trimmed straight and the edges vertical. Waste material resulting from such trimming or chipping shall be disposed of by the Contractor. Butt joints will be required only at locations designated on the Drawings. Unless the existing roadway profile requires modification by planing, all other connections shall be made by shimming or feathering to provide the necessary smooth riding connection.

Where the transition is to be made by shimming or feathering, it shall be accomplished at the time the final course is being constructed by raking out the oversize aggregates of the asphalt concrete mix being used. The Contractor shall not leave the asphalt open graded when feathering and shimming down to an existing surface. If approved by the Engineer, shimming and feathering may be accomplished at a later date. In such case, asphalt concrete Class G shall be used.

Surfaces to be in contact with the new asphalt shall be tacked in accordance with Section 5-04.3(5)B4.

Meet lines shall be sealed while the new asphalt concrete is still warm by painting with Special Tack Coat (STE-1) asphalt and then immediately covering the asphalt paint strip with clean, dry paving sand complying with Section 9-03.8(1).

#### **5-04.3(12) SAMPLES**

The Engineer reserves the right to have samples cut or cored from the completed pavement or the individual courses. Additionally, the Engineer may take samples of the uncompressed asphalt concrete mixtures as well as all Materials incorporated in the Work. Where samples have been taken from the uncompressed asphalt concrete, new Material shall be placed and compacted to conform with the surrounding area.

**5-04.3(13) SURFACE SMOOTHNESS**

The completed surface of all courses shall be of uniform texture, be smooth, have a continuous "plane" crown and grade, and be free from defects of all kinds. The completed surface of the wearing course shall not vary more than 1/8-inch from the lower edge of a 10-foot straightedge placed on the surface parallel to the centerline. The transverse slope of the completed surface of the wearing course shall vary not more than 1/4-inch in 10 feet from the rate of transverse slope shown on the Drawings.

When deviations in excess of, but not more than twice, the above tolerances are found, the pavement surface shall be corrected by the addition of asphalt concrete mixture of an appropriate class, submitted to the Engineer for approval, to low places, or the removal of Material from high places by grinding with an acceptable grinding machine. The corrected deviation shall be sealed. Where grinding or filling does not allow for an acceptable Pavement Structure, removal and replacement of the wearing course of asphalt concrete will be required. Correction of defects shall be carried out until there are no deviations anywhere greater than the allowable tolerances.

All areas in which the surface of the completed pavement deviates more than twice the allowable tolerances described above shall be removed and replaced.

However, if deviations are found which exceed the allowable tolerances but are not in excess of twice the allowable tolerances described above, and, in the opinion of the Engineer, correction by means of any of the methods specified above do not produce acceptable results as to smoothness and serviceability, the Engineer may accept the completed pavement and shall deduct from monies due or that may become due to the Contractor the sum of \$500.00 for each and every section of single traffic lane 100 feet in length in which any deviations as described above are found. Under the circumstances described above, the decision whether to accept the completed pavement or to require corrections as described above shall be vested entirely in the Engineer.

When Portland cement concrete pavement is placed on asphalt concrete pavement, the surface tolerance of the asphalt concrete pavement shall be such that no elevation lies above the proposed finished grade minus the specified depth of Portland cement concrete pavement. Prior to placing the Portland cement concrete pavement, any such irregularities shall be brought to the required tolerance by grinding or other means acceptable to the Engineer, at no expense to the Owner.

**5-04.3(14) RESERVED****5-04.3(15) ASPHALT CONCRETE DRIVEWAYS**

Asphalt driveways shall be constructed as shown on the Drawings.

The Contractor shall complete the necessary earthwork and provide a 3 inch compacted Asphalt Concrete, Class A over 6 inches of compacted Mineral Aggregate Type 2.

**5-04.3(16) WEATHER LIMITATIONS**

Asphalt for prime coat shall not be applied when the ground temperature is lower than 50°F.

Asphalt concrete Class D shall not be placed when the air temperature is less than 60°F. Asphalt concrete shall not be placed on any wet surface, or when the average surface temperatures are less than those specified in the following table, or when weather conditions prevent the proper handling or finishing of the bituminous mixtures:

Surface Temperature Limitations		
Compacted Thickness	Surface Course	Sub-Surface Courses
Less than 0.10 feet	55°F	45°F
0.10 to 0.20 feet	45°F	35°F
0.21 to 0.35 feet	35°F	35°F
More than 0.35 feet	D.N.A. <sup>1</sup>	25°F <sup>2</sup>

<sup>1</sup>Does not apply.

<sup>2</sup>Only on dry Sub-Surface Courses, not frozen and when air temperature is rising.

**5-04.3(17) PAVING UNDER TRAFFIC**

When the roadway being paved is open to traffic, the following requirements shall apply:

1. The Contractor shall keep intersections open to traffic at all times except when paving through the intersection. Such closures shall be kept to the minimum time required to place and compact the mixture and shall include advance warning to traffic of the intersection closure. Work shall be scheduled so that consecutive intersections shall not be closed at the same time. The asphalt shall cool to ambient temperature before any traffic is allowed on the new pavement. Traffic shall not be allowed on newly placed asphalt until approval has been obtained from the Engineer. The installation of advance warning signs, detours, and the maintenance of traffic shall be as specified in Section 1-07.23, Section 1-10, and the "Traffic Control Manual for In-Street Work".
2. During paving operations, center line stripes shall be maintained throughout the Project Site by applying temporary pavement marking tape each day to the roadway that was paved that day. Temporary centerline striping shall consist of placing strips of pressure-sensitive pavement marking tape at 10-15 foot intervals along the center line. Temporary marking tape shall be placed in sets of two 12-inch long strips of yellow 4-inch wide marking tape set 4 inches apart and parallel to the center line with each set of 1-foot double line



spaced 10 to 15 feet along the center line of the roadway. Additional temporary striping shall be installed wherever designated by the Engineer.

3. Temporary stop bars shall consist of a 12-inch wide stop bar made up of three parallel 4-inch strips of temporary pavement marking tape placed at locations designated by the Engineer. All other temporary pavement markings utilizing pavement marking tape shall be designated by the Engineer.
4. Pressure-sensitive pavement marking tape used on the wearing course prior to installation of permanent lane markers, traffic buttons, or permanent paint striping shall be removed from the pavement current with, or immediately subsequent to, the installation of permanent pavement markings. Damage to the pavement resulting from removal of temporary marking tape, including the use of high heat sources, shall be repaired by the Contractor at no expense to the Owner.
5. Temporary pavement markings shall be maintained in serviceable condition by the Contractor during the interval of time it is in use. Layout and marking in preparation for application and the application and removal of the temporary striping shall be the Contractor's responsibility. The Engineer will do the layout for permanent lane markings as specified in Section 8-22.3(1).
6. Within five days, weather permitting, after the preliminary layout of pavement marking control points has been completed by the Engineer, the Contractor shall install all permanent pavement markings. Installation shall be pursued vigorously thereafter until all permanent pavement markings and traffic channelization work is complete.

#### **5-04.3(18) CHANGE IN GRADE OF ASPHALT**

See Section 5-02.3(4).

#### **5-04.3(19) SEALING OF DRIVING SURFACES**

Any wearing course or other pavement course to be used for the driving surface will be evaluated by the Engineer to determine whether a fog seal is required. Determination will be made when the results of nuclear or core density testing show that a seal is needed, or when the Surface Course is asphalt concrete Class D. The Contractor shall apply a fog seal of CSS-1 at the rate 0.05 to 0.10 (0.03 to 0.05 residual) gallons per square yard prior to opening to traffic.

#### **5-04.3(20) ANTI-STRIPPING ADDITIVE**

The Contract, or the Engineer's approval of the Contractor's proposed mix design per Section 5-04.3(7), may require an anti-stripping additive be added to the asphalt Material in accordance with Section 9-02.4.

#### **5-04.3(21) SHOULDERS**

Shoulders, if required, shall be constructed to the lines, grades, and cross-sections specified. Material for building up shoulders shall be Mineral Aggregate Type 1.

#### **5-04.3(22) ASPHALT CONCRETE SIDEWALK**

Asphalt walkways shall be constructed at the locations and to the width specified on the Drawings.

Asphalt walkways shall be constructed with a 4 inch section of compacted crushed rock Mineral Aggregate Type 2 Base Course and covered with 2 inch compacted Class A asphalt concrete Surface Course.

#### **5-04.3(23) ASPHALT CONCRETE PAVEMENT PATCHING**

##### **5-04.3(23)A GENERAL**

The minimum dimension in any asphalt pavement repair area shall be 3 feet.

The placing and compaction of the trench backfill shall be as specified in Section 7-17.3(3). The preparation and compaction of the subgrade shall be completed prior to patching in accordance with Section 2-06.

Before the patch is constructed, all pavement cuts shall be trued so that the marginal lines of the patch form a rectangle with straight edges and vertical faces. The use of a concrete saw will not be required unless specified in the Contract. Cutting asphalt shall be in accordance with Section 2-02.3(3)A.

The use of proper signs, barricades, lights and other warning devices, shall comply with Sections 1-07.23 and 1-10.

On all public works Contracts, the Contractor shall restore pavement cuts with patching.

##### **5-04.3(23)B RIGID PAVEMENT RESURFACED WITH ASPHALT CONCRETE**

Asphalt concrete or bituminous plant mix shall not be placed until the cement concrete has met the requirements of Section 5-05.3(17). The edges of the existing asphalt pavements and castings shall be painted with STE-1 cationic special tack emulsion immediately before placing the asphalt patching Material (see Section 5-04.3(5)C2 for prime coat requirements). The asphalt concrete pavement shall then be placed, leveled, and compacted to conform to the adjacent paved surface. Immediately thereafter, all joints between the new and original asphalt pavement shall be painted with STE-1 asphalt emulsion and be covered with dry paving sand before the asphalt solidifies. Sealing of asphalt concrete patches shall be in accordance with the requirements of Section 5-04.3(19).

##### **5-04.3(23)C ASPHALT CONCRETE ON GRANULAR BASE**

After the subgrade and Base Course have been prepared, asphalt concrete pavement Class A shall be placed to a thickness of the existing asphalt pavement depth, or to a minimum of 3 inches, whichever depth is the greater, and compacted in the manner specified in this Section. The finished surface shall be in the same plane as existing roadway surface with smooth transition between the two surfaces.

Restoration of asphalt concrete roadway pavement on granular base shall consist of "Mineral Aggregate Type 2" to a compacted depth of 6 inches. "Pavement, Asphalt Concrete CI A" shall be compacted as specified in Section 5-04.3(10).

Restoration of MC-800 paved roadway surfaces, or seal coats, on a granular base shall consist of Mineral Aggregate, Type 2 compacted to 4 inch thickness and "Pavement, Asphalt Concrete CI A" to a 3 inch compacted thickness.

Restoration of asphalt driveways shall be the same as specified above for MC-800 pavements.

#### **5-04.3(23)E TEMPORARY PAVEMENT PATCHING**

The Contractor shall furnish, place and maintain a 2 inch minimum thickness crushed rock surfacing and a 2 inch minimum thickness MC-250 patch over trench areas. Such temporary asphalt patching will be required where roadway or walk is needed for traffic and permanent pavement cannot be placed immediately. The trench backfill shall be compacted as specified in Section 7-17.3(3) and the MC-250 tamped and leveled to coincide with adjacent surfaces. In the event that the temporary surface subsides after the initial placement, additional MC-250 and crushed surfacing shall be applied and maintained as necessary to maintain a surface level with existing pavement. Stockpile of the plant mix and crushed surfacing shall be provided on the site by the Contractor. Prior to final restoration of the pavement, the Contractor shall remove the temporary asphalt and crushed rock, clean the exposed face of the existing pavement, and restore the pavement.

#### **5-04.4 MEASUREMENT**

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for asphalt concrete pavement of the class specified will be by the ton whether the asphalt concrete is used for pavement, sidewalk, driveway, shims, feathering, or preleveling. The net weight of asphaltic concrete Materials being delivered to the Job Site shall be weighed in the transport Equipment on a certified platform scale, and with accuracy, as specified in Section 1-09.2.

Measurement will be based upon the actual quantity incorporated into the Work as determined by the Material load tickets received and accepted by the Engineer on the day the Material was delivered and incorporated into the Work. Deductions will be made for any asphaltic Material included in the measurement that is not incorporated into the Work on the day delivered.

Measurement for "Roadway Preparation" will be made by a single linear foot measurement along the centerline of the main roadway being prepared. All related intersections, side street approaches, and irregular shaped areas thereto will be incidental to this one measurement. Measurement will be to the nearest whole linear foot.

Measurement for "Surface Preparation, Plane Bituminous Pavement" will be by the square yard and will be based on the average depth, shown on the Drawings plus any additional depth up to 4 inch maximum to both cover removal of high spots and cover the extra depth required to provide a 4 inch reveal along the curb line as specified in Section 5-04.3(5)B3. Should the Drawings indicate or the Engineer order an area to be planed in excess of 4 inches, the square yards of surface planed will be increased by the actual area of surface planed in excess of 4 inches. If the Engineer directs an additional planing beyond the depth required above, the total quantity of planed surface will be increased to include the additional area replaned. The Engineer will determine depth of planing during each planing operation.

Measurement for "Surface Preparation, Prelevel" will be by the ton of asphalt concrete placed for preleveling surfaces based on the actual quantity incorporated into the Work as determined by the Material load tickets received and accepted by the Engineer on the day the Material was delivered and placed.

Measurement for "Plasticizing Rejuvenator" will be by the gallon. Measurement of quantities will be based upon the actual quantities incorporated into the Work.

Measurement of pavement patching will be by the ton for asphalt concrete and temporary MC-250 patching. Quantities for surface restorations for Sewers, drains and Water Mains will be based upon computations made by the Engineer using the required pavement patch thickness and the pavement and sidewalk removal criteria in Section 2-02.4.

Measurement of temporary pavement patch will be made for the initial placement only. Additional MC-250 and crushed rock surfacing required to maintain the surface of the temporary patch level with adjacent roadway surfaces will not be measured.

#### **5-04.5 PAYMENT**

Compensation for the cost necessary to complete the work described in Section 5-04 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. **"Pavement, Asphalt Concrete (Class)", per ton.**

The Bid item price for "Pavement, Asphalt Concrete (Class)" shall include all costs for the work required to furnish, haul, place and compact the asphalt concrete mix, including asphalt for tack coat, fog seal and sealing joints and meet lines, sand for joints and meet lines, sweeping and other preliminary surface preparation, and such other work as may be necessary and not otherwise set forth as a separate Bid item in the Bid Form.

All costs for the temporary pavement marking including installation, maintaining, and removing shall be included in the Bid item price Bid for "Pavement, Asphalt Concrete (Class)".

Asphalt concrete driveways, sidewalks, tapers, and feathered sections will be paid for as "Pavement, Asphalt Concrete (Class)".

If the Engineer orders a change in grade of paving asphalt, any additional compensation will be limited to the actual additional cost of the asphalt based on invoices from the Supplier. If the cost of the substituted paving asphalt is lower, the

difference in its cost and that of the original Material specified, based on invoices from the Supplier, will be deducted from monies due the Contractor.

2. **“Roadway Preparation”**, per linear foot.

The Bid item price for “Roadway Preparation” shall include all costs for the work required to prepare the untreated roadway, including scarifying, blading, shaping, and compacting to remove irregularities and secure a uniform surface except prime coat treatment which will be paid in accordance with Section 5-02.

3. **“Surface Preparation, Prelevel”**, per ton.

The Bid item price for “Surface Preparation, Prelevel” shall include all costs for the work required to prelevel uneven or broken surfaces by placing asphalt, by spot planing or such other work.

4. **“Surface Preparation, Plane Bituminous Pavement”**, per square yard.

The Bid item price for “Surface Preparation, Plane Bituminous Pavement” shall include all costs for the work required to prepare the surface including milling and planing, reworking or recycling existing surfacings, removing and disposing of cuttings, extra planing for butt joints, and feathering meet areas in preparation for an asphalt overlay of either leveling course or wearing course.

5. **“Plasticizing Rejuvenator”**, per gallon.

The Bid item price for “Plasticizing Rejuvenator” shall include all costs for the work required to rejuvenate the scarified Material.

6. **“Crack Sealing”**, per lump sum.

The Bid item price for “Crack Sealing” shall include all costs for the work required to clean and fill the cracks and joints.

7. **“Pavement Patch, Asphalt Concrete, (Class)”**, per ton.

The Bid item price for “Pavement Patch, Asphalt Concrete, (Class)” shall include all costs for the work required to permanently restore pavements or other traffic bearing surfaces which have been opened by trench excavation or similar work. All incidental work required to complete the patching of street surfaces as specified including all costs for tack coat shall be considered incidental to this Bid item.

8. **“Pavement Patch, Temporary, MC-250”**, per ton.

The Bid item price for “Pavement Patch, Temporary, MC-250” shall include all costs for the work required to install and remove the temporary patch. Mineral Aggregate (Type) will be paid in accordance with Section 4-01.5.

The costs for additional MC-250 and additional Mineral Aggregate Type required to maintain temporary pavement patches after the initial installation shall be at the sole expense of the Contractor.

9. **Other payment information.**

All costs for the rejection and disposal of Materials held for more than 24 hours after mixing, as specified in Section 5-04.3(8), shall be at the Contractor's sole expense and at no additional or separate cost to the Owner.

When cores are taken by the Engineer at the request of the Contractor, the Owner shall be reimbursed for the coring expenses as specified in Section 1-05.7.

Where samples have been taken from the uncompressed asphalt concrete, new Material shall be placed and compacted at no additional expense to the Owner.

If surface deviations are found which exceed the allowable tolerances but are not in excess of twice the allowable tolerances specified in Section 5-04.3(13), and, in the opinion of the Engineer, correction by means of any of the methods specified above produce unacceptable results as to smoothness and serviceability, the Engineer may accept the completed pavement and will deduct from monies due or that may become due to the Contractor the sum of \$500.00 for each and every section of single traffic lane 100 feet in length in which any deviations as described above are found. Under the circumstances described above, the decision whether to accept the completed pavement or to require corrections as described above shall be vested entirely in the Engineer.

Payment for backfill and compaction of the subgrade shall be included in the Bid item price for the particular Bid item(s) of Work necessitating the pavement cut.

Payment for crushed rock surfacing will be paid separately in accordance with Section 4-01 except as specified in “Pavement Patch, Temporary, MC-250”.

Payment for Material used for fog seal as specified in Section 5-04.3(19) will be paid as asphalt for tack coat.

Payment for anti-stripping additive as specified in Section 5-04.3(20) will be paid as asphalt for tack coat.

All costs for temporary pavement marking and removal shall be incidental to and included in the applicable Bid item prices and no separate or additional payment will be made.

All costs to repair pavement damaged by the removal of temporary marking tape specified in Section 5-04.3(17) shall be at the Contractor's sole expense and at no additional or separate expense to the Owner.

Payment for change in grade of asphalt, as specified in Section 5-04.3(18), will be in accordance with Section 1-09.4.

**SECTION 5-05 CEMENT CONCRETE PAVEMENT****5-05.1 DESCRIPTION**

Section 5-05 describes work consisting of constructing Portland cement concrete pavements in streets, roads, and alleys on a prepared subgrade or Base Course in conformity with the lines, grades, thicknesses, and typical cross-sections indicated on Standard Plans and as otherwise indicated in the Contract.

This work shall also consist of constructing Portland cement concrete edge walls, support walls and curb walls at locations shown on the Drawings, and shall further include concrete patching of various types of pavement cuts.

Concrete pavement patching is defined as the restoration of a small or narrow Pavement Structure cut, less than full panel width, resulting from trench excavation to install underground facilities. Concrete pavement restoration that requires full panel replacement shall be not be treated as "Patching".

**5-05.2 MATERIALS**

Materials shall meet the requirements of the following Sections:

Portland Cement	9-01
Concrete Aggregates	9-03.1
Joint Filler and Joint Sealant	9-04
Mortar for Edge and Support Wall	9-04.3(1)
Reinforcing Bar, Tie and Dowel Bars, and Wire Mesh Reinforcement	9-07
Curing Materials and Admixtures	9-23
Water	9-25.1
Epoxy Resins	9-26
Temporary Pavement Marking	9-29.4

The concrete mix for arterial pavement shall be Class 6.5 (1-1/2), and for residential streets and alleys shall be Class 6 (1-1/2).

Concrete for curb wall and for support wall shall be Class 6 (1-1/2).

Concrete mixes incorporating fly ash may be utilized for all classes of concrete. Mix proportions will be subject to approval by the Engineer and shall meet the requirements of Section 9-23.9.

Cement concrete pavement patch shall be Class 6.5 (1-1/2) H.E.S.

Water reducing admixtures shall meet the requirements of Section 9-23.6.

The use of calcium chloride will not be allowed.

All concrete mix designs shall be submitted to the Engineer for approval at least 10 Working Days in advance of ordering.

**5-05.3 CONSTRUCTION REQUIREMENTS****5-05.3(1) PROPORTIONING MATERIALS**

Each batch of concrete delivered to the Project Site shall be accompanied with a Manufacturer's Certificate of Compliance indicating the batch weights.

The class of concrete for non-structural uses refers to the nominal number of sacks of Portland cement per cubic yard concrete mix, although this designation does not constitute a guarantee of yield. The figure in parenthesis indicates the maximum size of aggregate particle. Example: "CI 5 (1-1/2)" is a 5 sack Portland cement concrete mix with 1-1/2 inch maximum size coarse aggregate.

H.E.S. indicates high-early-strength Portland cement and may be included in the class of concrete. Example: "CI 6 (1-1/2) H.E.S." is a 6 sack high early strength Portland cement concrete mix with 1-1/2 inch maximum size coarse aggregate.

With approval of the Engineer, the Contractor may use high-early-strength Portland cement in any of the mixes (see submittal requirement in Section 5-05.2).

Air-entrained concrete shall be used.

The volume of air in freshly mixed concrete shall conform to that specified in the following table:

<b>Air Content of Freshly Mixed Concrete</b>	
<b>Maximum Size of Coarse Aggregate (Inches)</b>	<b>Air Content Percent by Volume</b>
1-1/2, 2 and 3	5 ± 1
3/4 and 1	6 ± 1
3/8 and 1/2	7-1/2 ± 1

If the measured air content is found outside the range of values contained in the table, the Contractor shall immediately make changes in mixing or Materials as necessary to comply with the requirements for air content.

Fine and coarse aggregates shall be proportioned by weight except that if Project pavement construction is small, volumetric proportioning may be used with advanced permission of the Engineer. In proportioning, the unit of measure for Portland cement will be by the 94 pound sack.

Weights of fine and coarse aggregate are based on a bulk specific gravity, saturated surface dry, of 2.67.

Concrete mixes shall be proportioned as specified in the table which follows. The weight of each size of aggregate is the estimated quantity to be used with one sack of cement. With approval of the Engineer (see submittal requirements in Section 5-05.2), the proportion of aggregate may be altered to give better workability.

<b>Class of Concrete (Maximum Aggregate Size)</b>	<b>5 (3/4)</b>	<b>5 (1-1/2)</b>	<b>5.5 (1-1/2)</b>	<b>6 (3/4)</b>	<b>6 (1-1/2)</b>	<b>6.5 (1-1/2)</b>	<b>Section Reference</b>
28 day Compressive Strength, lbs. per sq. in.	2,300	2,300	2,500	3,000	3,000	3,600	....
Sacks per Cubic Yard	5	5	5.5	6	6	6.5	....
Pounds dry Fine Aggregate No. 1	....	275	248	....	220	210	9-03.1(2)
Pounds dry Fine Aggregate No. 2	291	....	....	203	....	....	9-03.1(2)
Pounds No. 2 Coarse Aggregate	....	....	....	....	....	280	9-03.1(3)
Pounds No. 4 Coarse Aggregate	....	166	150	....	132	....	9-03.1(3)
Pounds No. 5 Coarse Aggregate	387	248	223	320	201	....	9-03.1(3)

In adjusting concrete mixes, the following water-cement ratios shall not be exceeded:

<b>Cement Sacks (Sacks Per Cubic Yard)</b>	<b>Maximum Water (Gallons Per Sack)</b>
4	8.2
5	6.5
5.5	6.0
6	5.5
6.5	5.1

### 5-05.3(2) CONSISTENCY (SLUMP REQUIREMENTS)

The Materials shall be mixed with sufficient water to produce a stiff concrete which holds its shape when deposited upon the Base Course or subgrade. Concrete placed during wet weather shall be mixed with sufficient water to produce a very stiff mixture. The consistency shall be such that separation of the mortar from the coarse aggregate shall not occur in handling.

Slump shall be measured in accordance with ASTM C 143 "Method of Test for Slump of Portland Cement Concrete".

The water/cement ratio shall not produce a mix with a slump greater than 2 inches for other than slip form construction, and ½ inch for slip form construction. Concrete slump with water-reducing agent shall not exceed 3-1/2 inches. A water-reducing agent shall be added to the concrete mix when:

1. The Contractor elects to hand-screed and/or hand-finish concrete paving work in lieu of using a mechanical finishing machine, or
2. Increased workability is necessary due to weather conditions or other variables, and is acceptable to the Engineer.

### 5-05.3(3) EQUIPMENT

Equipment necessary for handling Materials and performing all parts of pavement construction shall require approval by the Engineer as to design, capacity, and mechanical condition. The Equipment shall be at the Project Site sufficiently ahead of the start of paving operations to be examined thoroughly.

#### 1. Batching plant and Equipment:

- a. **General:** The batching plant shall include bins, weighing hoppers, and scales for the fine aggregate and for each size of coarse aggregate. If cement is used in bulk, a bin, hopper, and separate scale for cement shall be included. The weighing hoppers shall be properly sealed and vented to preclude dusting during operation. The batching plant shall be equipped with a suitable nonresettable batch counter which correctly indicates the number of batches proportioned.
- b. **Bins and hoppers:** Bins with adequate separate compartments for fine aggregate and for each size of the coarse aggregate shall be provided in the batching plant.
- c. **Scales:** Plant and truck scales shall meet the requirements of Section 1-09.2.
- d. The batching plant shall be equipped to proportion aggregates and bulk cement by means of automatic weighing devices of an approved type.

#### 2. Mixers:

- a. **General:** Concrete may be mixed at a batching plant or wholly or in part in truck mixers. Each mixer shall have attached in a prominent place a manufacturer's plate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.
- b. **Batching plant:** Mixing shall be in an approved mixer capable of combining the aggregates, cement, and water into a thoroughly mixed and uniform mass within the specified mixing period.

The mixer shall be equipped with an approved timing device which automatically locks the discharge lever when the drum has been charged and releases it at the end of the mixing period. The device shall be equipped with a bell or other suitable warning device adjusted to give a clearly audible signal each time the lock is released.

Mixers shall be cleaned at suitable intervals. The pickup and throw-over blades in the drum or drums shall be repaired or replaced when they are worn down 3/4 inch or more. The Contractor shall have available at the Project Site a copy of the manufacturer's design, showing dimensions and arrangements of the blades in reference to original height and depth, or provide permanent marks on blades to show points of 3/4 inch wear from new conditions. Drilled holes 1/4 inch in diameter near each end and at midpoint of each blade are recommended.

- c. **Truck mixers and truck agitators:** Truck mixers used for mixing and hauling concrete, and truck agitators used for hauling plant-mixed concrete, shall conform to the requirements of Section 6-02.3(4)C.
  - d. **Nonagitator trucks:** Bodies of nonagitating hauling Equipment for concrete shall be smooth, mortar-tight, metal containers and shall be capable of discharging the concrete at an acceptable controlled rate without segregation. If discharge of concrete is accomplished by tilting the body, the surface of the load shall be retarded by a suitable baffle. Covers shall be provided when needed for protection. Plant-mixed concrete may be transported in nonagitated vehicles provided that the concrete is delivered to the site of pavement construction and discharge is completed within 45 minutes after the introduction of mixing water to the cement and aggregates, and provided the concrete is in a workable condition when placed.
3. **Finishing Equipment:**
- a. The standard method of constructing concrete pavement on roadways shall be with one or more self-propelled paving machines which spread, screed, shape and consolidate the freshly placed concrete between stationary side forms. The Contractor may option to use approved slip-form paving Equipment designed to spread, consolidate, screed and float-finish the freshly placed concrete in one complete pass of the machine with minimum of hand finishing.
  - b. On Projects requiring less than 500 square yards of cement concrete pavement or on Projects requiring individual placement areas of less than 500 square yards, irregular areas and at locations inaccessible to self-propelled paving Equipment, cement concrete payment may be placed with approved placement and hand finishing Equipment utilizing stationary side forms. Hand screeding and float finishing of cement concrete pavement may only be utilized on small irregular areas as allowed by the Engineer.
  - c. Along with the basic tools required for compacting and finishing concrete pavement, a long handle, 10-foot metal straight edge for checking the surface smoothness as described in Section 5-05.3(12), shall be furnished by the Contractor and shall be at the site of pavement construction prior to the commencing of placing concrete. The straight edge shall be lightweight, straight and true, equipped with a long handle to allow for checking the smoothness of the surface along the entire width of the pavement section.
4. **Joint Sawing Equipment:**
- a. The Contractor shall provide approved power driven saws for sawing joints, adequate in number of units and power to complete the sawing at the required rate. The Contractor shall provide at least one standby saw in good working order. An ample supply of saw blades shall be maintained at the site of the pavement construction at all times during sawing operations. The Contractor shall provide adequate artificial lighting facilities for night sawing. All of this Equipment shall be on the pavement construction site both before and continuously during concrete placement. Sawing Equipment shall be available immediately and continuously upon call by the Contractor on a 24 hour basis, including Saturdays, Sundays and Holidays.
5. **Smoothness Testing Equipment:**
- a. Along with the basic tools required for compacting and finishing concrete pavement, a long-handle, 10-foot straight edge for checking the surface smoothness as described in Section 5-05.3(12) shall be furnished by the Contractor and shall be at the site of pavement construction prior to the commencing of placing concrete. The straight edge shall be lightweight, straight and true, equipped with a long handle to allow for checking the smoothness of the surface along the entire width of the pavement section.
  - b. On large paving Projects ("large" is defined as 1000 LF or more of continuous concrete pavement) the Contractor shall provide a California type computerized profilograph, complete with recorder, for determining the profile index of the pavement according to WSDOT Test Method No. 807.  
The profilograph shall be on the Project Site, calibrated, in good working condition, and ready for operation before construction of any concrete pavement begins.  
The operator shall be competent and experienced in operation of the Equipment.

#### 5-05.3(4) HANDLING, MEASURING, AND BATCHING MATERIALS

The batch plant site, layout, Equipment, and provisions for transporting Material shall ensure a continuous supply of Material to the location of pavement construction. See Section 5-05.3(1) regarding batch ticket reporting requirements.

##### 1. Measuring Materials:

- a. **Aggregates:** The fine aggregate and each size of coarse aggregate shall be measured by weighing, the weight for the particular aggregates used being proportional to their respective bulk specific gravities. The weighing of each size of Material shall be a separate and distinct operation. Corrections shall be made for variations in weight of Materials due to the moisture content.

The Equipment for weighing aggregates shall conform to the requirements of Section 1-09.2.

- b. **Cement:** Cement shall be weighed on scales meeting the requirements of Section 1-09.2. Adequate provision shall be made to prevent loss of cement between the batch box and the mixer.
- c. **Water:** Water may be measured either by volume or by weight. The accuracy of measuring the water shall be within a range of error of not over 1 percent.

## 2. **Batching Materials:**

- a. On all Projects requiring more than 2,500 cubic yards of Portland cement concrete for paving, the batching plant shall be equipped to proportion aggregates and cement by weight by means of automatic and interlocked proportioning devices of approved type.

### 5-05.3(5) **MIXING CONCRETE**

#### 5-05.3(5)A **GENERAL**

The concrete may be mixed in a batching plant or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time shall be measured from the time all Materials are in the drum. Ready-mixed concrete shall be mixed and delivered in accordance with the requirements of Section 6-02.3(4).

When mixed in a batching plant, the mixing time shall not be less than 50 seconds nor more than 90 seconds.

The mixer shall be operated at a drum speed as shown on the manufacturer's name plate on the mixer. Any concrete mixed less than the specified time shall be discarded and disposed of by the Contractor at no expense to the Owner. The volume of concrete mixed per batch shall not exceed the mixer's rated capacity, as shown on the manufacturer's standard rating plate on the mixer.

Each concrete mixing machine shall be equipped with a device for counting automatically the number of batches mixed during the day's operation.

All elements of a batch shall be simultaneously and continuously fed to the mixer to ensure uniform distribution of cement, water, aggregates, and admixtures.

Retempering concrete by adding water or by other means will not be permitted. Admixtures for increasing the workability or for accelerating the set will be permitted only when specified, or when approved by the Engineer.

#### 5-05.3(5)B **LIMITATIONS OF MIXING**

Concrete shall not be mixed, placed, or finished when the natural light is inadequate, unless an adequate and approved artificial lighting system is operated.

Mixing and placing concrete shall be discontinued when a descending air temperature in the shade away from artificial heat reaches 40°F and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 35°F unless authorized in writing by the Engineer.

When mixing and placing is authorized during cold weather, the aggregates may be heated by either steam or dry heat prior to being placed in the mixer. The apparatus used shall heat the mass uniformly and shall be arranged to preclude the possible occurrence of overheated areas which might injure the Materials. The temperature of the mixed concrete shall be not less than 50°F and not more than 90°F at the time of discharge into the hauling conveyance. No concrete shall be mixed with frozen aggregates.

#### 5-05.3(6) **SUBGRADE**

Subgrade shall be constructed, and maintained, in accordance with the requirements of Section 2-06.

Where thickened edges for pavements are required, such as shown on the Standard Plans, the subgrade shall be excavated and shaped to provide for the section shown.

Wherever possible, traffic and Equipment shall be kept off the finished subgrade. If Equipment must travel on the subgrade ahead of the paving, a power drag shall be carried immediately ahead of placing concrete. Irregularities in the subgrade caused by any Equipment during the placement of concrete shall be smoothed out and compacted immediately ahead of placing the concrete.

### 5-05.3(7) **PLACING, SPREADING, AND COMPACTING CONCRETE**

All the requirements for concrete mix, density, finish and surface smoothness apply regardless of the methods used to place concrete pavement.

#### 5-05.3(7)A **CONCRETE PAVEMENT CONSTRUCTION - GENERAL**

Concrete shall be placed, spread, and consolidated between stationary forms by means of an approved paving machine or an approved slip-form paver at the Contractor's option. Hand methods of spreading and consolidating concrete shall be limited to pavement patching, to small panel replacement, to irregular areas, and to pavement placed in confined areas.

Where Pavement Structures have grades of 4 percent or more, the direction of the paving operation shall be uphill, starting from the lowest street elevation.

Unless otherwise specified in the Contract, paving widths from 25 feet to 44 feet shall be paved in 2 operations with compensation allowed for thickened edge on each side of the included longitudinal construction joint. Should the Contractor be allowed to pave in more than 2 operations for the above widths, the additional thickened edges required due to installation of more than one construction joint shall be made at no additional expense to the Owner. When "hand" screeding methods are allowed, paving widths shall not exceed 12 feet on arterials or 13 feet on non-arterials. Full-width paving will be allowed only with written permission of the Engineer.

Keyways shall be provided at all longitudinal construction joints and at transverse construction joints without dowels.

Mixers and trucks shall be operated on the subgrade or on the shoulder adjacent to the lane being paved. Newly paved lanes shall not be used for mixers, trucks or other construction Equipment unless the concrete pavement meets the requirements set forth in Section 5-05.3(17).

A protective ramp shall be constructed at the Pavement Structure edge where Equipment may be driven on and off the existing pavement. The forms shall be left on the outside edge of the first lane at all turnouts until the pavement is opened to traffic.

Where tie bars are required, they shall be placed before the concrete is poured, except when slip form paving machines equipped with an approved tie bar insertion device are used (see Standard Plan no. 405). If the tie bars impede the flow of traffic, the tie bars shall be protected from traffic by bending down the back against the side form. Prior to placing concrete in the adjacent lane, the tie bars shall be straightened.

An 1/8-inch thick metal plate, 5 inches wide and no less than 10 feet long, shall be placed flat on top of the completed pavement along its edge at the common joint with the adjacent pavement slab to be poured. The concrete shall be struck off from this plate, either by machine or by hand placement methods.

All pavement and other surfaces in use by the Contractor shall be kept adequately moist to prevent the accumulation of dust on the freshly placed concrete.

#### **5-05.3(7)B SLIP FORM CONSTRUCTION**

At the option of the Contractor and with the approval of the Engineer, concrete pavement may be constructed by the use of slip-form paving Equipment.

Slip-form paving Equipment shall be provided with traveling side forms of sufficient dimensions, shape and strength to support the concrete laterally for a sufficient period of time during placement to produce pavement of the required cross section and the Equipment shall spread, consolidate, screed, and float-finish the freshly placed concrete in such a manner as to provide a dense and homogenous pavement.

The concrete shall be distributed uniformly into final position by the slip-form paver and the horizontal deviation in alignment of the edges shall not exceed the 1/2 inch from the alignment established by the Engineer.

The paver shall vibrate the concrete for the full width and depth of the strip of pavement being placed and the vibration shall be adequate to provide a consistency of concrete that stands normal to the surface with sharp well defined edges. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms.

The plastic concrete shall be effectively consolidated by internal vibration with transverse vibrating units for the full width of pavement and/or a series of equally spaced longitudinal vibrating units. The space from the outer edge of the pavement to the outer longitudinal unit shall not exceed 9 inches. The spacing of internal units shall be uniform and not exceed 18 inches.

The term internal vibration means vibration by vibrating units located within the specified thickness of pavement section and a minimum distance equal to the pavement thickness ahead of the screed.

The rate of vibration of each vibrating unit shall be not less than 7500 cycles per minute, and the amplitude of vibration shall be sufficient to be perceptible on the surface of the concrete along the entire length of the vibrating unit and for a distance of at least 1 foot. The frequency of vibration or amplitude shall be varied proportionately with the rate of travel to result in a uniform density and air content. The paving machine shall be equipped with a tachometer or other suitable device for measuring and indicating the actual frequency of vibrations.

The concrete shall be held at a uniform consistency, having a slump as specified in Section 5-05.3(2). The slip-form paver shall be operated with as nearly a continuous forward movement as possible and all operations of mixing, delivering, and spreading concrete shall be coordinated to provide uniform progress with stopping and starting of the paver held to a minimum. If, for any reason, it is necessary to stop the forward movement of the paver, the vibratory and tamping elements shall also be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.

Regardless of the method or machinery used to construct pavement, depressed curb for driveways and ramps shall be provided at those locations indicated on the Drawings or as required by the Engineer. When a slip-form paving machine is used for pavement construction, the Contractor shall block out the pavement area beneath areas where depressed curb is to be constructed. Such blocked out pavement areas, together with the depressed curb sections, shall then be constructed concurrently with the cement concrete item needing the depressed curb.

When concrete is being placed adjacent to an existing pavement, that part of the Equipment which is supported on the existing pavement, shall be equipped with protective pads on crawler tracks or rubber-tired wheels and shall be offset to run a sufficient distance from the edge of the pavement to avoid breaking or cracking the pavement edge.

After the concrete has been given a preliminary finish by the finishing devices in the slip-form paving Equipment, the surface of the fresh concrete shall be checked with a straight-edge to comply with the tolerances and finish specified in Section 5-05.3(12).



With slip-form construction, tie bars shall be set in place along the longitudinal joint. Keyway will not be required on sawcut longitudinal joints.

#### **5-05.3(7)C STATIONARY SIDE FORM CONSTRUCTION**

Forms and headers and their placement shall meet the requirements of Section 5-05.3(21).

The concrete shall be placed upon the prepared subgrade or base between the forms to the required depth and cross section in a continuous operation between construction or expansion joints. No concrete shall be placed until the forms are approved by the Engineer.

The concrete shall be thoroughly consolidated by mechanical vibration. Complete consolidation is required along all forms or adjoining pavements by such means which prevent gravel pockets along the edges of the finished pavement. Any gravel pockets found after removing the forms shall be repaired by the Contractor.

When integral curb is being constructed with the pavement, fresh concrete for the integral curb shall be placed at such time which enables the top section of the curb to be consolidated, finished, and bonded to the pavement slab while the concrete is plastic.

Where curb is required, and such curb is not being placed integrally with the pavement slab, dowels shall be placed in the pavement slab as specified in Section 8-04.

#### **5-05.3(7)D PLACING CONCRETE AT THROUGH JOINTS**

Concrete placement around through joints shall be such that the through joint assembly shall not be disturbed and that it shall remain in a straight line perpendicular to the subgrade, as shown on the Standard Plans. The concrete shall then be vibrated along the entire length of the joint to consolidate the concrete and leave no rock pockets anywhere at the joint.

#### **5-05.3(7)E PLACING CONCRETE WITH REINFORCING STEEL OR WIRE MESH**

Concrete shall not be placed until the subgrade and the reinforcing steel or wire mesh has been approved by the Engineer. The Contractor shall use positive reinforcing steel or wire mesh as shown on Drawings and shall ensure the reinforcing steel or mesh is not displaced as the concrete is placed.

Reinforcement shall be free of dirt, mill scale, oil, grease, or other foreign Material that may impair bond. Steel, coated with rust, may be used if the oxidations are not deep or loose coated.

Requirements for placing and fastening reinforcing steel are specified in Section 6-02.3(24)D.

Successive mats of steel or wire mesh shall be securely lapped together and tied so that longitudinal bars lap a minimum 40 diameters and wire mesh laps 6 to 12 inches.

Reinforcement shall be laid as a continuous mat. Continuity shall be maintained between expansion joints. Steel shall terminate at the designated locations in the slab.

#### **5-05.3(7)F COMPACTING CONCRETE**

##### **5-05.3(7)F1 GENERAL**

All cement concrete pavement shall be vibrated. Vibration shall be by internal vibration, and/or surface vibration.

##### **5-05.3(7)F2 INTERNAL VIBRATION**

Internal vibrations shall comply with Section 6-02.3(9) except that slip-form paver vibration shall comply with Section 5-05.3(7)B, and combined vibration and machine compaction shall comply with Section 5-05.3(7)F4.

##### **5-05.3(7)F3 MACHINE COMPACTION**

The machine used for compacting shall be self-propelled and designed to run on the side forms. Movable parts shall be capable of adjustment and they shall be adjusted so as to produce accurately the roadway sections shown on the Drawings. The machine shall be equipped with two reciprocating screeds. The tops of the forms shall be kept clean with a suitable device attached to the machine.

The travel of the machine on the forms shall be maintained true without lift, wobble or other variations which might prevent a precise strike off.

The machine shall be put in forward motion as soon as concrete is deposited on the subgrade. On the first pass, a roll of concrete shall be carried ahead of the screed. Screeds and tampers shall be operated so as not to disturb expansion joints and caps.

Machines shall be operated prior to placing longitudinal and transverse dummy joints.

Machines shall be operated at least twice and as many more times as may be necessary to compact concrete free from rock pockets, and to a section that can be finished properly.

Care shall be exercised not to overwork the concrete and being an excess of mortar to the surface.

##### **5-05.3(7)F4 COMBINED VIBRATION AND MACHINE COMPACTION**

The combined vibration and compaction Equipment shall be demonstrated as being capable of consolidating the concrete across the full width of the pavement into a homogenous mass, free of rock pockets, and without separation of mortar and aggregate.

The vibration Equipment shall be either as described in Section 5-05.3(7)F3, or shall be an approved spreading machine to which is attached a vibrating unit composed of individual internal vibrators spaced not more than 29 inches apart. The vibrators shall be spaced equidistantly, and the distance from the side forms to the nearest vibrator shall not exceed 14

inches. The vibrators shall be carried behind and independent of the strike-off screed of the spreading machine, or ahead of and independent of the strike-off screed of the first compacting machine.

The vibrating unit shall not rest upon the side forms nor impart vibration to the strike-off screeds. The individual vibrators shall be attached to a frame in a manner which permits adjustment of both the depth of penetration into the concrete and the angle of the vibrator with the horizontal.

The entire vibrating unit shall allow raising the vibrator tips completely clear of the concrete surface.

The vibrator shall be capable of vibrating at rates between 4,800 and 8,000 pulses per minute when inserted in the concrete. All vibrators shall be synchronized to vibrate at a frequency specified by the Engineer, within the limits established.

On the first trip over the freshly placed concrete the vibration Equipment shall be submerged in the concrete to ensure adequate consolidation. The vibration Equipment shall be operated on the first pass only. The vibration Equipment shall not be operated when the machine is not in motion except when vibrating near an expansion joint.

After the first pass with vibration, additional passes without vibration shall comply with Section 5-05.3(7)F3.

#### **5-05.3(7)F5 VIBRATING SCREED CONCRETE PAVEMENT CONSTRUCTION**

The type of vibrating screed which the Contractor proposes to use, whether roller or beam, shall be subject to the approval of the Engineer. Upon request by the Engineer, a test section of pavement shall be placed for the purpose of demonstrating the capabilities of the screed to acceptably compact and strike off the concrete to the established grade and section.

Concrete shall be uniformly distributed between the forms and it shall then be compacted and screeded to the level of the top of the forms by means of the vibrating screed. Supplemental compaction by mechanical vibration of the concrete adjacent to the forms will be required if the concrete cannot be acceptably compacted by the vibrating screed.

The vibrating screed shall be operated over the freshly placed concrete in successive passes only a sufficient number of times to obtain maximum compaction. Over-vibration of the concrete, resulting in an excess of mortar at the surface of the pavement, will not be permitted.

After the final passages of the vibrating screed, the surface of the concrete shall be at the established pavement grade and cross section and shall be sufficiently smooth as to require only a very moderate amount of hand finishing for smoothness to meet approval of the Engineer.

#### **5-05.3(8) JOINTS**

##### **5-05.3(8)A GENERAL**

Transverse and longitudinal joints shall be contraction or through joints (including construction joints). Joints shall be constructed in accordance with Standard Plan no. 405 and shall be of the type and at the locations indicated on the Drawings. The faces of all joints shall be constructed perpendicular to the surface of the cement concrete pavement.

##### **5-05.3(8)B CONTRACTION JOINTS**

##### **5-05.3(8)B1 FORMED CONTRACTION JOINTS**

Formed contraction joints shall be constructed by embedding a 1/4-inch thick premolded joint Material as indicated on Standard Plan no. 405. The depth of the formed joints shall be 1/3 of the pavement thickness. The filler shall be cut to the exact section of the joint. The length of the premolded joint filler shall extend to within 1/4-inch of any panel edge.

Transverse contraction joints (dummy joints) shall be placed after compaction and finishing of concrete have been completed and before initial set. A vertical groove shall be cut into the surface at the location of the joint, using a tool provided with stops (tee iron) to prevent cutting the groove deeper than the planned depth. The preformed joint Material shall then be embedded into the groove until the top is flush with the pavement surface, with a deviation of not more than 1/8-inch below the surface. The joint filler shall be perpendicular to the surface and always in a straight line.

After the joint filler has been embedded in the concrete, the surface of the pavement shall be finished against the filler strip with hand floats to restore the surface finish. While performing this operation, the filler strip shall be maintained in a perpendicular position, true to alignment. After finishing the entire area, the joint shall be true to grade, smooth and without irregularities.

The premolded joint filler may be omitted provided the joints are subsequently sawed in accordance with the provisions of Section 5-05.3(8)B2.

##### **5-05.3(8)B2 SAWED CONTRACTION JOINTS**

Sawed contraction joints shall be constructed by sawing a vertical groove in the hardened concrete on an approved schedule after placing and before development of random cracks in the concrete slab. The depth of sawcut shall be 1/3 the pavement thickness and shall not cut underlying pavement tie bars and dowel bars (see Standard Plan no. 405). Transverse contraction joints shall be sawed before the longitudinal joints are sawed. The first set of transverse joints shall be sawed at a maximum of 60 foot intervals, as soon as the cut can be made without undue raveling of concrete. Intermediate joints shall be sawed immediately following the first set of joints. The Contractor shall provide the Engineer a minimum 4 hours advance notice of sawcutting.

Any scheduling for the sawing of joints that results in premature or uncontrolled cracking shall be revised immediately by adjusting the time interval between placing of concrete and the sawing of joints. After the revised schedule has been accepted by the Engineer, the sawing shall proceed as a continuous operation until all joints have been completed.

Two or more sawing units may be required to accomplish the sawing in order to minimize random cracking. Standby Equipment shall be on the job to ensure continuity of sawing regardless of any breakdown of Equipment.

Where curing membrane is used, the area disturbed by sawing of joints shall be resprayed immediately upon completion of the sawing operation and care shall be exercised to prevent the curing compound from getting into the groove. Joint sealing compound shall not adhere to concrete if curing compound is present.

The concrete saw shall be powered adequately to perform the required cutting. It shall cut a uniform groove to the required depth and not less than 3/16-inch nor more than 5/16-inch in width. The Contractor will be expected to so arrange the schedule of sawing joints, including initial sawing, at the required intervals so that every possible effort is made to control cracking by the use of judiciously spaced and timed sawed joints. In the event random cracks occur, they shall be repaired in accordance with Section 5-05.3(22). The Contractor shall provide at least one standby saw in good working order to insure continuous sawing as specified regardless of any breakdown of Equipment. An ample supply of sawblades shall be maintained at the site of pavement construction at all times during sawing operations. The Contractor shall provide artificial lighting facilities for night sawing. All Equipment required for sawing shall be at the pavement construction site both before and continuously during concrete placement. Sawing Equipment shall be available immediately and continuously on a 24 hour basis, including Saturdays, Sundays and legal Holidays.

Damage to curing Material caused by sawing operations shall be repaired immediately after completion of sawing.

Formed transverse contraction joints shall be installed where designated by the Engineer, if necessary to prevent uncontrolled transverse cracks from occurring before the pavement can be sawed.

#### **5-05.3(8)B3 SEALING SAWED CONTRACTION JOINTS**

Sawed contraction joints shall be filled with a joint sealant filler conforming to the requirements of Section 9-04.2. Joints shall be thoroughly cleaned at the time of sealing. If hot-poured type sealant is used, the joints shall be dry. Care shall be taken to avoid air pockets. The hot-poured compound shall be applied in two or more layers, if deemed necessary by the Engineer. The cold-poured compound shall be applied under sufficient pressure to fill the groove from the bottom to a point approximately 1/4-inch below the surface of the concrete. The joint filled with cold-poured compound shall then be covered with a strip of nonabsorptive paper at least twice as wide as the joint. The paper shall be left in place.

If contraction joints are formed with plastic strips, sealing is not required.

Excess sealing Material shall be cleaned off the surface of the pavement before opening to traffic.

#### **5-05.3(8)C THROUGH JOINTS**

#### **5-05.3(8)C1 EXPANSION JOINTS**

Expansion joints are placed only where shown on the Drawings. The joint alignment shall be at right angles to the Pavement Structure centerline unless otherwise specified in the Contract.

Longitudinal expansion joints shall be placed where shown on the Drawings or where required for concrete pavement between or along retaining walls, curbs or other structures.

Expansion joints shall be constructed with premolded Material, 3/4-inch in thickness, and conform to Section 9-04.1(2). They shall extend from 1 inch below the subgrade to 1 inch below the top of the pavement. Transverse expansion joints shall extend the full width of Pavement Structure.

The joint Material shall be held accurately in place during the placing and finishing of the concrete by a bulkhead, a holder, a metal cap or any other approved method. The joint shall be perpendicular to the paved surface and the holder shall be in place long enough to prevent sagging of the Material, especially on streets having steep grades.

In multiple lane construction, the joints shall be matched so as to form a continuous alignment across all lanes.

Expansion joints shall extend continuously through all curbs, special care being exercised to preserve alignment perpendicular to the pavement in the curb section.

A wood filler strip or metal cap shall be placed on the top of the premolded joint filler to form the groove 1 inch deep, and it shall remain in place until after the finishing and the concrete is sufficiently set to resist sloughing into the groove. The joint filler shall be stapled together at the ends to preserve continuity.

Immediately after removal of side forms, the edges of the pavement shall be carefully inspected and wherever the joint filler is not fully exposed, the concrete shall be chipped down until the edge of the filler is fully exposed for the entire depth.

#### **5-05.3(8)C2 CONSTRUCTION JOINTS**

All longitudinal construction joints shall be constructed with keyway and tie bars as detailed on Standard Plan no. 405. Along with keyway and tie bars, a thickened edge shall be required on pavements less than 9 inches in thickness for Type B joints, and less than 10 inches thickness for Type A joints.

Transverse construction joints formed by placing a header board transversely across the subgrade shall be made at the end of each day's paving or when placing of standard mixed concrete is discontinued for more than 60 minutes or when placing of high early strength concrete is discontinued for more than 30 minutes. The header board shall be located to conform to the spacing for the transverse contraction joints (or an expansion joint) and shall be left in place until the paving is resumed. If the location of the header board is to be a contraction joint, then the header shall have fastened to the concrete side a wedge-shaped strip of wood or preformed plastic to form a key in the concrete. Thickened edge shall be constructed at the construction joint header to provide ample depth of concrete above and below the keyway. For dowel bar requirements, see Section 5-05.3(10).

Where preformed contraction joints are used, the joint made by the construction joint header shall have a 2-inch strip of joint Material imbedded against the hardened concrete when paving is resumed.

#### **5-05.3(8)C3 SEALING THROUGH JOINTS**

After the pavement is cured, and before carrying any traffic, the space left by the removal of the wood filler strip or the metal cap above the top of the expansion joint filler strip shall be thoroughly cleaned of all loose material. The 3/4-inch wide groove shall be completely free of any projecting concrete from the sides and the groove shall be continuous across the slab to each edge. It shall then be filled level with the pavement surface with joint sealant meeting the requirements of Sections 9-04.2(2).

The joint sealant Material shall be heated and placed in accordance with the manufacturer's instructions. Burned Material will be rejected. The through joint groove shall be dry at the time of pouring the sealing compound.

#### **5-05.3(8)D JOINT LOCATION**

##### **5-05.3(8)D1 TRANSVERSE JOINTS**

Standard spacing of transverse contraction joints along straight sections of Pavement Structures (between through expansion joints or between intersections or other irregular areas), shall be at intervals no greater than 15 feet across the full width of the Pavement Structure and at right angles to the center line of Traveled Way. Where the spacing between transverse through expansion joints or between intersections or other irregular areas are not in even multiples of 15 feet, the last several spaces approaching the expansion joint or header shall be varied by shortening the spaces. The Contractor shall give advance notice to the Engineer and coordinate the spacing. On horizontal curves, the joint spacing of 15 feet shall be measured along the outer edge of the outside lane and at right angles to the center line.

When paving adjacent to existing pavement or a previously paved lane, the new transverse joints shall be placed to match joint locations in the adjacent pavement. Where the existing joint spacing is greater than 15 feet, intermediate transverse joints shall be constructed. The Contractor shall give advance notice to the Engineer and coordinate the spacing.

For intersections and other irregular areas, the arrangement of contraction joints shall be in accordance with standard intersection patterns. The area of any one irregular panel formed by contraction joints in intersections shall not exceed 225 square feet and its greatest dimensions shall not exceed 15 feet. The Contractor shall give advance notice to the Engineer and coordinate the spacing.

Where uncontrolled cracks have appeared or exist in the adjacent lane, they shall be matched as nearly as possible by uniform transverse joints in the second lane. In the event uncontrolled cracks in the existing paved lane are too frequent or in random locations and impossible to match with a uniform spacing in the second lane, the two lanes shall be completely separated by 3/4-inch joint Material along the length of the joint from 1/8 inch below the surface to one inch below the bottom of the concrete being placed.

Where integral curb or doweled curb is placed along the concrete pavement, premolded joint filler Material shall be placed transversely across the full section of the curb in true alignment with the pavement joint, perpendicular to the pavement grade.

All joints in an intersection shall be considered transverse joints except those joints that terminate normal to the curb radii.

##### **5-05.3(8)D2 LONGITUDINAL JOINTS**

Standard locations for longitudinal joints for the following pavement widths, whether contraction or construction, shall be in accordance with the following table unless specified otherwise in the Contract.

<b>Width Curb to Curb</b>	<b>Joint Locations</b>
25 Feet	Center line
32 Feet	Center line and 10 feet each side of center
36 Feet	Center line and 10 feet each side of center
40 Feet	Center line and 12 feet each side of center
44 Feet	Center line and 11 feet each side of center or match existing joint

In the event the roadway is divided into two lanes, the construction joints shall be located on the center line of the roadway. In separate lane construction, a joint filler 1/4-inch by 2 inches shall be placed between the two lanes when the second lane is constructed.

#### **5-05.3(9) CASTINGS AND STEEL REINFORCING BARS IN CONCRETE PAVEMENT**

Reinforcing steel bars shall be used to reinforce concrete pavement and rigid base around Standard Plan nos. 230 and 351 castings except when the casting crosses or is less than 18 inches near any pavement joint. A casting 18 or fewer inches from any pavement joint shall have 2 squares of steel reinforcement (rebar) placed around the casting at mid-depth of the concrete pavement slab. No. 4 rebar shall be used to form the 2 separate squares with the squares rotated 45 degrees from each other. The clearance of any rebar from the casting shall be a minimum of 2 inches to a maximum of 6 inches. Each set of 4 rebars shall have rebar length such that each bar is lapped at each end with connecting bars with 3 inch overlap. In no case shall any rebar be within 3 inches of any pavement joint.

**5-05.3(10) TIE BARS AND DOWEL BARS****5-05.3(10)A DOWEL BARS**

Dowel bars will be required in new pavement at all transverse joints of arterials, intersections, and bus and commercial non-arterials. The dowels shall be installed at the midpoint of the thickness of the pavement, parallel to the surface of the pavement and perpendicular to the transverse joint. The tolerances for placement shall be  $\pm 1/8$ -inch. The size and spacing of dowel bars shall be as indicated on Standard Plan no. 405. The dowel bars shall be held in place during the placing and setting of the concrete. Dowel bars are not required between new pavement and existing pavement, unless otherwise indicated in the Contract. Joints normal to curb radii will not require dowel.

The dowels shall be installed by method of seating the dowels or by use of a dowel bar cage extended across the width of the transverse joint or by other methods approved by the Engineer. Dowel bars shall be coated with grease to prevent corrosion and dowel seizure. The grease coating on the dowel bars shall remain intact after installing and placing the concrete. Where dowel cages are used to support the dowels, the metal rod or wire ties used to hold the cage together during shipping shall be totally removed after the cage has been placed and secured to the base or subgrade and prior to the placement of the concrete Material.

**5-05.3(10)B TIE BARS**

Tie bars shall be placed at all longitudinal construction joints in accordance with Standard Plan no. 405. Tie bars are not normally required at longitudinal contraction joints or longitudinal joints between new and existing pavement unless otherwise indicated in the Contract. Tie bars shall be located at the required elevation and spacing shown on the Drawings and placed in such a manner that the vertical edge of the concrete is not deformed or damaged during placement of the bars. Joints normal to curb radii will not require dowel.

**5-05.3(11) FINISHING****5-05.3(11)A GENERAL**

The pavement shall be consolidated and the surface finished true to grade and cross-section by hand or machine finishing methods. On all vertical curves at irregular intersections, modified tools shall be provided as necessary to secure a smooth, uniform contour and surface.

**5-05.3(11)B SLIP-FORM CONSTRUCTION**

After the concrete has been given a preliminary finish by means of finishing devices incorporated in the slip-form paving Equipment, the surface of the fresh concrete shall be checked by the Contractor with a straightedge device not less than 10 feet in length. High areas indicated by the straightedge device shall be removed by the hand-float method. Each successive check with the straightedge device shall lap the previous check path by at least 1/2 of the length of the straightedge. The requirements of this paragraph may be waived, upon the approval of the Engineer, if the Contractor can successfully demonstrate that other means can consistently produce a surface meeting the 10-foot straightedge requirement specified in Section 5-05.3(12).

Any edge slump of the pavement, exclusive of specified edging, in excess of 1/4 inch shall be corrected before the concrete has hardened. If edge slump on any 1 foot or greater length of hardened concrete exceeds 1 inch, the entire panel between the transverse and longitudinal joints shall be removed and replaced with concrete true to the specified line, grade, and cross-section.

High spots exceeding 1/4-inch shall be reduced by suitable grinding methods. Low spots exceeding 1/4-inch shall be filled with an epoxy-bonded grout. The Contractor shall submit to the Engineer for approval, the proposed epoxy grout and the method of applying the epoxy grout repair.

**5-05.3(11)C STATIONARY SIDE FORM CONSTRUCTION****5-05.3(11)C1 HAND FINISHING**

After the concrete has been struck off and consolidated, it shall be smoothed by longitudinal floating. Movement ahead shall be in successive advances of not more than 1/2 the length of the float. Floating shall continue until all irregularities are removed. Longitudinal floating shall follow compaction of the concrete by not less than 30 feet. Free water on the pavement shall be removed with the float or other suitable tool. After floating, the surface shall be scraped with a grout rod at least 10 feet in length with a long handle for operating at the edge of the pavement. The grout rod shall be operated to correct irregularities in the pavement surface and remove water and laitance. Contraction joints shall be placed after all floating has been completed in accordance with provisions of Section 5-05.3(8)B2.

**5-05.3(11)C2 MACHINE FINISHING**

The finishing machine shall be of a type approved by the Engineer. The machine shall be adjustable to both crown and plane of the finished pavement surface. The screed shall oscillate longitudinally during its travel transversely across the pavement. It shall be operated in the forward direction so that the screed passes over the same section of pavement at least 2 times during its transverse travel.

The finishing machine shall be moved over the pavement as many times as is necessary to give the pavement a smooth even textured surface, conforming to the exact crown and cross section specified on the Drawings.

The floating shall not be considered complete until all free water is removed from the surface.

The finishing operations shall be performed at a time and over such lengths of the pavement surface as existing conditions necessitate.

**5-05.3(11)D EDGING**

Before the final finishing is completed and before the concrete has taken the final set, the pavement shall be edged as indicated in the following table:

Location	Radius
Edge of Pavement	1/2-inch
Contraction Joints	1/4-inch
Through or Construction Joints	1/2-inch

Particular attention shall be given to edge at the appropriate time. The concrete shall have attained a partial set and all free water shall have disappeared so that the edged joints are clearly defined with no tearing or slump of the edges.

**5-05.3(11)E FINAL FINISH**

After edging but prior to texturing, the Contractor shall demonstrate to the Engineer that the surface is ready for texturing by performing the surface smoothness checks as called for in Section 5-05.3(12). Any areas which do not comply with the specified tolerances shall be corrected and rechecked prior to texturing.

As the pavement surface is checked and approved for smoothness, the Contractor shall finish the surface with a uniform, gritty texture, true to grade and cross section. The final finish shall be accomplished by one of the methods described as follows to achieve the specified surface texture.

Before using either the drag, brush or comb, the concrete shall have set sufficiently so that the surface is not overgrooved or gouged in the finishing operation.

**Burlap Finish:** A burlap drag having at least 3 feet of drag in contact with the pavement and as wide as the pavement section shall be dragged forward over the pavement surface. The burlap drag shall be wet and clean when in use. The burlap shall not be left on the pavement surface between dragging operations.

**Brush Finish:** After edging, the pavement shall be brushed transversely with a fiber or wire brush of a type approved by the Engineer. The brush strokes shall be perpendicular to the center line with the adjacent strokes slightly overlapped. Care should be taken to make sure texture finish is uniform throughout the pavement surface.

**Rough Finish:** The Contractor shall give the pavement a final finish surface by texturing with a comb perpendicular to the center line of the pavement. The comb shall produce striations approximately 0.015 foot in depth at approximately 1/2-inch spacings in the fresh concrete. The comb shall be operated mechanically either singly or in gangs with several placed end to end. Finishing shall take place with the elements of the comb set at 45 degrees to the concrete surface to eliminate dragging the mortar. If the striation Equipment has not been previously approved, a test section shall be constructed prior to approval of the Equipment. If the pavement has a raised curb without a formed concrete gutter, the texturing shall end 2 feet from the curb line. This 2-foot untextured strip shall be hand finished with a steel trowel.

**5-05.3(11)F UTILITY ADJUSTMENTS**

Utility castings shall be adjusted to finished grade prior to the construction of the final wearing course (Section 7-20).

**5-05.3(12) SURFACE SMOOTHNESS**

The surface smoothness shall be checked with a straightedge 10 feet long, mounted to a long handle to permit operation from outside the pavement. The straightedge shall be placed on the surface of the pavement parallel to the centerline and at intervals of no more than 5 feet across the full width of the pavement so as to bridge any depressions and touch all high spots. Should the surface of the pavement, when tested with a 10 foot straightedge, vary from the true surface grade more than 1/8-inch in 10 feet on arterials, 1/4-inch in 10 feet on residential streets, 3/8-inch in 10 feet in alleys, 3/8-inch in 10 feet in concrete bases, and 1/8-inch in 10 feet in concrete bases for unit pavers, the Contractor shall correct the surface grade by redoing it's finish operation.

On Projects with large amounts of concrete paving ("large" is defined as constructing 1000 linear feet of continuous concrete pavement), the pavement smoothness shall be checked under supervision of the Engineer following placement of concrete, with Equipment furnished and operated by the Contractor. Smoothness of all pavement placed, except small or irregular areas, shall be measured with a recording profilograph, as specified in Section 5-05.3(3), parallel to centerline, from which the profile index will be determined by the Engineer in accordance with WSDOT Test Method No. 807.

The transverse slope of the finished pavement shall be uniform to a degree such that no variation greater than 1/8-inch is present when tested with a 10 foot straightedge laid in a direction perpendicular to the centerline.

In no case shall the grade in the pavement or gutter be such that allows ponding of water. If the surface smoothness of the pavement after curing is found to exceed the tolerance permitted, the high spots shall be ground until they meet tolerance. If the surface tolerance cannot be met acceptably by grinding, the pavement shall be removed and replaced in conformity with the Specifications.

Only Equipment and methods that consistently produce a finished surface meeting the requirements specified herein shall be used. Use of Equipment or methods which do not meet these Standard Specifications shall be discontinued until the Contractor can revise and demonstrate changes in construction operations that meet the requirements of the Specifications.

If for any reason these surface smoothness checks are not performed, the Engineer may require the Contractor, as a condition of acceptance, to submit a report from a testing laboratory approved by the Engineer certifying that the surface smoothness complies with the specified tolerances, and that the testing laboratory is certified to do smoothness testing by either WSDOT or AASHTO.

**5-05.3(13) CURING****5-05.3(13)A CURING PERIOD**

Regardless of the curing method used, the Contractor shall maintain the curing protection and protect from damage from any cause for at least the length of time listed in the table that follows for the various mixes, exclusive of the day the concrete is placed, or until the pavement is opened to traffic, whichever comes first:

Type II Portland Cement Concrete Pavement	7 Days
High-Early-Strength Cement Concrete Pavement	5 Days
Concrete Mixes Containing Fly Ash	14 Days

**5-05.3(13)B CURING METHODS****5-05.3(13)B1 GENERAL**

Immediately after the finishing operations have been completed and as soon as marring of the concrete can not occur, the entire surface of the newly placed concrete shall be covered and cured in accordance with one of the methods in the following subsections as the Contractor may elect.

Pavement edges which are exposed by the removal of the forms shall be protected by the immediate application of a curing medium of moist earth.

All curing Materials shall be free of all substances which are considered to be harmful to Portland cement. The curing medium shall be capable of preventing checking, cracking, and dry spots regardless of conditions existing at the time of placement. Concrete placement will not be permitted unless curing Materials are on the Project Site and ready for immediate application. Failure to comply with all provisions of the curing procedures hereinafter specified will be sufficient reason to suspend all concrete operations.

When the curb section is to be placed separately, the surface of the pavement directly underneath the curb section shall be covered with a protective cover to protect that area from the curing agent when the pavement is sprayed.

**5-05.3(13)B2 WHITE PIGMENTED CURING COMPOUND**

White pigmented curing compound, meeting the requirements of Section 9-23.2, Type 2, Class B, shall be applied on the entire area of exposed surface of the new concrete with an approved mechanical spray machine. Wax base curing compound will not be allowed. The spray fog shall be protected from the wind with an adequate shield. It shall be applied uniformly at the rate of one gallon to not more than 150 square feet.

The curing compound shall be applied with Equipment which ensures continuous agitation of the compound during spraying operations. The nozzle shall be of the two line type with sufficient air to properly atomize the compound.

The curing compound shall not be applied during or immediately after rainfall. If it becomes necessary to leave the pavement uncoated overnight, it shall be covered with polyethylene sheeting which shall remain in place until weather conditions are favorable for the application of the curing compound.

In the event that rain falls on the newly coated pavement before the film has dried sufficiently to resist damage, or in the event of damage to the film from any cause, the Contractor shall apply a new coat of curing compound in one or two applications to the affected area at the rate which results in a film of curing value equal to that specified in the original coat.

Containers of curing compound shall be distributed on concrete pavement in a manner to enable the Engineer to determine the rate of application being used at any time. All curing compound placed in the spray tanks shall be withdrawn directly from manufacturer's original containers bearing the manufacturer's name, brand, and lot number.

Curing compound shall be thoroughly agitated in accordance with the manufacturer's recommendations before placing in the tank. The compound shall not be diluted by the addition of solvents nor be altered in any manner. If the compound has become chilled to the extent that it is too viscous for proper stirring or application or if portions of the vehicle have been precipitated from solution, it shall be heated to restore proper fluidity but it shall not be heated above 100°F.

The curing compound shall be applied immediately after the concrete has been finished and after any bleed water that has collected on the surface has disappeared, or at a time designated by the Engineer. If hair checking develops in the pavement before finishing is completed, the Engineer may order the application of the curing compound at an earlier stage, in which event any concrete cut from the surface in finishing operations shall be removed entirely from the pavement. If additional mortar is then needed to fill torn areas, it shall be obtained ahead of the spraying operations. All areas cut by finishing tools subsequent to the application of the curing compound shall immediately be given new applications at the rate specified above.

The curing compound, after application, shall be protected by the Contractor from injury for the period of time specified above. All traffic shall be considered as injurious to the film of the applied compound.

The Contractor shall provide on the job a sufficient quantity of white polyethylene sheeting to cover all the pavement laid in three hours of maximum operation. This sheeting shall be reserved exclusively for the protection of the pavement in case of rain or breakdown of the spray Equipment used for applying the curing compound. The protective sheeting shall be placed over the pavement in a manner approved by the Engineer.

Areas from which it is impossible to exclude traffic shall be protected by a covering of sand or earth not less than 1 foot in thickness or by other suitable and effective means. The protective covering shall be placed no earlier than 24 hours after application of the compound.

All liquid membrane-forming curing compounds shall be removed from the Portland cement concrete pavement to which traffic delineators are to be bonded. Curing compound removal shall not be started until the pavement has attained

sufficient flexural strength for traffic to be allowed on it. The Contractor shall submit a proposed removal method to the Engineer and shall not begin the removal process until the Engineer has approved the removal method.

#### **5-05.3(13)B3 WHITE POLYETHYLENE SHEETING**

The sheeting shall be placed over the pavement immediately after finishing operations are completed, or at a time designated by the Engineer.

The sheeting shall be laid so that individual sheets overlap at least 2 feet, and the lapped areas shall be held in close contact with the pavement by weighting with earth or boards to prevent movement by the wind. The sheeting shall extend downward to cover the edges of the pavement and shall be secured to the subgrade with a continuous bank of earth or surfacing Material. Any holes occurring in the sheeting shall be patched immediately. The sheeting shall be maintained against injury and remain in place the minimum period of time as specified above.

White polyethylene sheeting shall conform to the requirements of Section 9-23.1.

#### **5-05.3(13)B4 WET CURING**

As an alternative to the above curing methods, the Contractor may wet cure the concrete pavement. Wet curing shall be accomplished by applying a continuous fog or mist spray to the entire pavement surface 24 hours a day for a minimum of 7 days. If water runoff is not a concern, continuous sprinkling is acceptable. Sprinkling shall not begin until the concrete has achieved initial set as determined by AASHTO T 197 or other pre-approved method.

#### **5-05.3(13)B5 TRANSPARENT CURING COMPOUND**

The use of transparent liquid curing compounds shall be restricted to areas not exceeding 1,000 square yards.

The curing compound shall be Type 1D as specified in Section 9-23.2. Sufficient pigment shall be present so that the sprayed compound is easily discernible. The application and the curing shall be the same as for "White Liquid Membrane Curing Compound" in Section 5-05.3(13)B2.

#### **5-05.3(13)B6 EMULSIFIED ASPHALT**

Curing of concrete pavement when laid as a base for an asphalt wearing course shall comply with Section 5-05.3(20).

#### **5-05.3(13)C CURING IN HOT WEATHER**

In periods of low humidity, or drying winds, or high temperatures a fog spray shall be applied to concrete as soon after placement as conditions warrant in order to prevent the formation of shrinkage cracks. The spray shall be continued until conditions permit the application of a liquid curing membrane or other curing media. The Engineer shall make the decision when the use of a fog spray is necessary.

#### **5-05.3(14) COLD WEATHER WORK**

When the air temperature is expected to reach the freezing point during the day or night and the pavement has not cured for 50 percent of the time specified in Section 5-05.3(13)A, the concrete shall be protected from freezing. The Contractor shall, at no expense to the Owner, provide a sufficient supply of straw, hay, grass, earth, blankets, or other suitable insulating blanket material and spread it over the pavement to a sufficient depth to prevent freezing of the concrete. The Contractor shall be responsible for the quality and strength of the concrete thus cured. Any concrete injured by frost action or freezing shall be removed and replaced.

#### **5-05.3(15) CONCRETE PAVEMENT CONSTRUCTION IN ADJACENT LANES**

Refer to Section 5-05.3(7)A.

#### **5-05.3(16) PROTECTION OF PAVEMENT**

The Contractor shall protect the pavement and its appurtenances from any damage. Protection shall include personnel to direct traffic and the erection and maintenance of warning signs, lights, barricades, temporary take-down bridges across the pavement with adequate approaches, and whatever other means may be necessary to accommodate local traffic and to protect the pavement during the curing period or until opened to traffic as specified in Section 5-05.3(17). See Sections 1-07.23 and 1-10.

#### **5-05.3(17) OPENING PAVEMENTS TO TRAFFIC**

The Contractor shall not open newly constructed cement concrete pavement to traffic, including construction Equipment, until the pavement has cured for the period of time specified in Section 5-05.3(13)A and has attained the required compressive strength. Approval to open newly constructed pavement to the use of construction Equipment (or other traffic) in less time than the time period specified in Section 5-05.3(13)A will be limited to those paving situations when the Contractor is unable to use the subgrade or Base Course of the lane being paved, or the shoulder adjacent to it, for paving Equipment.

Approval will be conditioned upon the Contractor agreeing to the following restrictions:

1. The concrete in the newly paved lane has attained a flexural strength of 500 psi as determined with a Beam Test pursuant to AASHTO T 177 or ASTM C 293.
2. The Beam Test is performed at the Contractor's expense by an independent materials laboratory retained by the Contractor. The laboratory retained by the Contractor shall be a laboratory accredited by a recognized standards organization and be acceptable to the Engineer.
3. The surface of the new pavement shall be protected from scarring and abrasion by operating mixers, trucks, and other construction Equipment on mats, skids, or other protective devices approved by the Engineer. Accumulation of sand, gravel, dirt, concrete or other debris deposited on the new pavement shall be



removed daily. Curing compound protection damaged as a result of using the paved lane shall be replaced concurrent with spraying of curing compound on the newly placed concrete.

4. The Contractor shall remove and replace at no expense to the City any panels on the new pavement that are cracked or broken as a result of the Contractor's early opening of the lane to traffic.

Streets with curbs shall not be opened until the curb has cured for at least 72 hours and has attained 2500 psi strength. If the curb has not attained the above-mentioned 2500 pounds per square inch strength, the Contractor shall protect the curb by placing form lumber on the pavement 2 feet away from the curb, or standard barricades and maintain them (see Sections 1-07.23 and 1-10). Such curb protection shall remain in place as long as may be necessary for protection of the curb. See Section 8-04.3(1)E for concrete curb curing requirements.

Streets shall not be opened to traffic until the smoothness criteria specified in Section 5-05.3(12) have been verified by the Engineer.

Temporary pavement markings, when required by the Engineer, shall be installed, maintained, and subsequently removed in accordance with Section 5-04.3(17).

Prior to opening for traffic, the Contractor shall clean the pavement. The Engineer will determine when the pavement is ready for traffic.

#### **5-05.3(18) CEMENT CONCRETE APPROACHES**

Concrete approaches shall be constructed at the locations shown on the Drawings or as staked by the Engineer and in accordance with WSDOT Standard Plan no. F4.

Concrete approach construction shall comply with the provisions of Section 5-05. In addition, placing, compacting, and finishing concrete approaches may be by hand methods as approved by the Engineer.

#### **5-05.3(19) REINFORCED CONCRETE BRIDGE APPROACH SLABS**

Approach slab concrete shall be Class AX conforming to the requirements of Section 6-02.3.

Reinforced concrete bridge approach slabs shall be constructed at the locations shown on the Drawings or as staked by the Engineer and in accordance with the Contract.

The approach slabs shall be constructed full bridge deck width from outside usable shoulder to outside usable shoulder at an elevation to match the Structure. Pavement ends and the bridge ends of the approach slabs shall be modified as shown on the Drawings to accommodate the grate inlets at the bridge ends if the grate inlets are required.

Screed rail support, installation, and finish machine requirements shall be as specified for bridge deck slabs.

Reinforced concrete bridge approach slab anchors shall be installed as detailed on the Drawings. For Method A anchor installations, the grout or adhesive used to install the anchors shall have a minimum compressive strength of 4000 psi at three days and be capable of developing the ultimate strength of the anchor rod. The anchor rod shall be ASTM A 36 steel. Compressive strength shall be determined in accordance with AASHTO T 106. The anchors shall be installed parallel both to profile grade and center line of roadway. The Contractor shall secure the anchors to ensure that they do not become misaligned during concrete placement.

The compression seal shall be as noted in the Contract (see Section 6-02.3(13)B).

Finishing of the reinforced concrete bridge approach slabs shall be accomplished by either a combination of finishing machine and hand finishing or by hand finishing methods only. The finished and cured approach slabs shall be free from any deviation exceeding 1/8 inch under a 10-foot straightedge placed parallel and perpendicular to the center line of the roadway.

#### **5-05.3(20) UNFINISHED CEMENT CONCRETE PAVEMENT**

Cement concrete pavement that is intended as a base for an asphalt wearing course, shall conform to all requirements of Section 5-05 with the following exceptions:

1. The surface tolerance shall be 3/8 inch in 10 feet.
2. The surface of the concrete base, if hand compacted, may be struck off with only one strike-off rod.
3. Contraction joints shall be constructed as follows:
  - a. A weakened plane shall be made in the plastic concrete every 15 feet or to match existing cracks as designated by the Engineer.
  - b. The plane shall be weakened with a joint cutter to a minimum depth of 2 inches.
  - c. Bulging caused by the joint cutter shall be corrected by floating lightly.
  - d. Joint Material shall be placed completely through the curb at the point where the weakened plane intersects the curb.
4. Liquid curing compounds which leave a waxy film on the concrete shall not be used for curing concrete base pavement. If cured with a liquid curing compound, it shall meet the requirements of Section 9-23.2 for the clear type and the rate of coverage shall be at least one gallon per 125 square feet; or emulsified asphalt CSS-1 or CRS-1 meeting the requirements of Section 9-02.1(6) applied at a rate between 0.15 gallon and 0.25 gallon per square yard of surface.

#### **5-05.3(21) SIDE FORMS**

Side forms shall have a height of not less than the specified depth of pavement, and thickened edge when applicable, and shall be of ample strength to resist deformation. They shall be provided with adequate devices for secure setting so that when in place they shall withstand, without visible springing or settlement, the weight, impact, and vibration of the finishing machines. The forms shall be free from warps, bends, or kinks.

Forms shall be drilled in advance for tie bar placement to line and grade where tie bars are specified.

Forms shall remain in place at least 12 hours after the concrete has been placed and shall be cleaned and oiled each time they are used. Curing compound shall be applied to the concrete immediately after the forms are removed.

The alignment and grade elevations of the forms shall be checked and the necessary corrections made by the Contractor immediately before placing the concrete. When any form has been disturbed or any subgrade thereunder has become unstable, the form shall be reset and rechecked.

Forms may be of wood or metal or any other material at the option of the Contractor, provided the forms as constructed result in a pavement of specified thickness, cross section, grade, and alignment as shown on the Drawings.

Forms shall be adequately supported to prevent deflection or movement, and result in concrete pavement conforming with the Contract. The top of the forms shall not deviate more than 1/8-inch in 10 feet and the alignment of forms shall be within 1/4-inch in 10 feet. The forms may be removed the day after pouring if the concrete is sufficiently set to withstand removal without danger of chipping or spalling. When forms are removed before the expiration of the curing period, the edges of the concrete shall be protected with moist earth or sprayed with curing compound. All forms shall be cleaned, oiled and examined for defects before they are used again.

#### **5-05.3(22) REPAIR OR REPLACEMENT OF DEFECTIVE PAVEMENT PANELS**

##### **5-05.3(22)A GENERAL**

Damage to new and existing concrete pavement caused by Contractor operations or by defective and unauthorized work (ie. broken panels, cracks, nonworking joints, spalls, etc.) shall be addressed in accordance with Section 1-05.7.

##### **5-05.3(22)B CRACK RESTORATION**

Pavement slab containing more than one crack shall be removed and replaced in its entirety.

Prior to joint sealing, pavement slab containing a single crack shall be removed and replaced such that the minimum dimension of the removed slab is six (6) feet long and full panel width. The portion of panel to remain in place shall have a minimum dimension of six (6) feet in length and full panel width, otherwise the entire panel shall be replaced. There shall be no new joints closer than three (3) feet to an existing transverse joint. Saw cutting full pavement depth is required along all longitudinal joints and at transverse locations. Tie bars and dowel bars shall be used in accordance with Section 5-05.3(10).

##### **5-05.3(22)C SPALL AND EDGE SLUMPING RESTORATION**

Spalls and edge slumping shall be repaired by making vertical saw cuts at least three (3) inches outside the affected area and to a minimum depth of three (3) inches. Repair depths that exceed one third of the total slab depth or encounter dowel bars or reinforced steel will require full depth repair. When the affected area is directly against a longitudinal or transverse joint, a debonding medium (compressible joint insert or polyethylene strip) shall be placed between the existing concrete and the area to be patched. For transverse joints, the compressible joint material shall be placed into the existing joint one (1) inch below the depth of the repair and extended at least three (3) inches beyond each end of the patch boundaries. If the affected area is directly against an asphalt pavement, a formed edge even with the surface is required. The concrete in the affected area shall be chipped out to sound concrete with a pneumatic hammer with a maximum weight of 30 pounds. The formed cavity shall be sand blasted thoroughly clean and all loose material removed. Where required, an epoxy bonding agent shall be applied fully covering the dry cleaned surface of the cavity with a thin even coat. Placement of Portland cement concrete or epoxy concrete or mortar shall immediately follow the application of the epoxy bonding agent. The epoxy bonding agent shall meet the requirements of Section 9-26 for Type II epoxy (Portland cement concrete placement) or Type III epoxy (epoxy concrete or mortar placement). Low areas which grinding cannot feasibly remedy, shall be sandblasted, filled with epoxy bonding mortar, and textured by grinding. The epoxy bonding agent shall meet the requirements of Section 9-26 for Type II epoxy. The patch mixture shall be placed and vibrated to eliminate any voids. Vibrators greater than one (1) inch shall not be used. If cementitious repair material is used, the patch perimeter shall be sealed with a 1:1 cement:water grout. The patch mixture shall be cured according to the manufacturer's recommendation.

#### **5-05.3(23) CEMENT CONCRETE PAVEMENT FOR ALLEY**

##### **5-05.3(23)A PAVEMENT AND ALLEY REQUIREMENTS**

Cement concrete pavement for alleys shall meet the requirements of Section 5-05 and Standard Plan no. 403. Alleys shall meet the requirements for driveways in Section 8-19.

##### **5-05.3(23)B EXTRA CONCRETE FOR ALLEY APPROACH RAMP**

When constructing and finishing cement concrete alley pavement, the Engineer may in some cases require the Contractor to place additional concrete over the surface of the alley pavement to serve as an integral ramp or vehicular access to abutting private property. Such extra concrete shall be placed and finished to the additional thickness directed by the Engineer. Additional thickness for such ramps shall not exceed 6 inches above the original planned concrete surface at any point, and will be addressed in accordance with Section 1-04.4. See Standard Plan no. 430.

##### **5-05.3(23)C CURB WALL AND SUPPORT WALL**

##### **5-05.3(23)C1 GENERAL**

Where shown on the Drawings, the Contractor shall construct the curb wall, and either the edge wall or support wall as shown on Standard Plan no. 403. The alley width indicated on the Drawings shall be taken to the face of the curb and as shown on Standard Plan no. 403.

After removal of forms, all lips and edgings shall be removed. Bolts or concrete ties shall be removed and the holes filled with 1:2 mortar and floated to an even uniform surface. If in the opinion of the Engineer an acceptable surface has been obtained, no further finishing shall be done. If, however, the surface is unacceptable, these surfaces shall be thoroughly washed with water and a 1:1 mortar applied with brush and completely worked into the small air holes and other crevices. After initial set, the surface shall be rubbed with a damp sack.

**5-05.3(23)C2 CURB WALL**

Curb wall shall be constructed as indicated on Standard Plan no. 801.

**5-05.3(23)C3 SUPPORT WALL**

Support wall shall be constructed as indicated on Standard Plan no. 800.

**5-05.3(24) CONCRETE UNDERPINNING**

Where designated by the Engineer, existing concrete foundations left above grade shall be supported with concrete underpinning.

**5-05.3(25) WATER**

Water for pavement construction shall be furnished as provided in Section 2-07 (also see Section 9-25.1).

**5-05.3(26) PAVEMENT PATCHING****5-05.3(26)A GENERAL**

Concrete pavement restoration shall be considered "Pavement Patch" when due to a trench cut and the width of the opening is less than the full concrete panel width. Concrete pavement patching shall be scheduled to accommodate the demands of traffic, and shall be performed as rapidly as possible to accommodate public travel.

The placing and compaction of the trench backfill shall be in accordance with the applicable Sections of Division 7 and Division 8, and the preparation and compaction of the subgrade shall be in accordance with Section 2-06.

Before applying the patch, all pavement cuts shall be trued so that the cut edges of pavement form a rectangle with straight edges and vertical faces. The use of a concrete saw will be required for Portland cement concrete pavement as specified in Section 2-02.3(6). Line drilling will be allowed for asphalt overlaid Portland cement rigid pavement base.

Cement concrete pavement patch shall be the class of concrete specified in Section 5-05.2. Curing compound shall be as specified in Section 5-05.3(13).

Signing, barricades, lights and other warning devices shall be as specified in Sections 1-07.23 and 1-10 and shall be maintained until the patch is completed and ready for traffic.

**5-05.3(26)B CEMENT CONCRETE PAVEMENT**

Streets which have rigid type pavements surfaced with asphalt concrete shall be patched as shown on Standard Plan nos. 404a and 404b. The thickness of concrete pavement patch shall match the existing rigid base or 9 inches, whichever is greater. The top surface of the concrete shall match the top surface of the existing rigid base; in no case shall the top of the concrete be higher than the top of the existing rigid base. Brush finishing will not be required. Joints shall be placed to match existing joints. Curing shall be accomplished with STE-1 asphalt emulsion diluted with water.

When the existing street surface is cement concrete, the concrete pavement patch shall be placed, compacted, and struck off to the grade of the adjacent pavement. Through joints and dummy joints shall be placed and edged to match existing joints. The surface shall be finished and brushed with a fiber brush or combs or tines. Approved curing compound shall be placed on the finished concrete immediately after finishing.

**5-05.3(27) TEMPORARY PAVEMENT PATCHING**

Temporary pavement patching shall be in accordance with Section 5-04.3(23)E.

**5-05.3(28) CASTINGS IN CONCRETE PAVEMENT**

See Sections 5-05.3(9) and 7-20.

**5-05.4 MEASUREMENT**

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for pavement or pavement base will be by the square yard of concrete in place, including the area placed underneath curbs. No deduction will be made for castings in pavement.

Measurement for thickened edge will be by the linear foot as measured along the thicker face of the thickened edge.

Measurement for concrete underpinning will be by cubic yard placed as computed by the Engineer.

Measurement for edge wall, support wall and curb wall will be per cubic yard of concrete based on neat lines indicated on Standard Plan nos. 403, 800, and 801.

Steel required for pavement reinforcement (Section 5-05.3(7)E) will be measured by the pound of rebar in place.

Tiebars and dowels required for pavement and curbs, and reinforcing steel for castings will not be measured.

Measurement for curb constructed with alley pavement will be in accordance with Section 8-04.

Measurement of concrete pavement patching will be by the cubic yard for cement concrete patching. Quantities for surface restorations for trench excavations, other than for electrical conduit trench as specified in the immediately following

paragraph, will be based upon computations made by the Engineer using the required pavement patch thickness and the removal criteria specified in Section 2-02.3(3). Concrete pavement restoration requiring full concrete pavement panel replacement will be measured as pavement or pavement base as specified in this Section.

Measurement for pavement patching for electrical conduit construction as specified in Section 8-33 will be based on actual measured dimensions with the width of restoration no greater than 24 inches unless the measurement requirements of The Street and Sidewalk Pavement Opening and Restoration Rules require otherwise.

#### 5-05.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 5-05 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. **"Pavement, Cement Concrete (Class), (Thickness)",** per square yard.
2. **"Pavement Base, Cement Concrete (Class), (Thickness)",** per square yard.

The Bid item prices for "Pavement, Cement Concrete (Class), (Thickness)" and for "Pavement Base, Cement Concrete (Class) (Thickness)" shall include all costs for the work required to furnish and install concrete pavement as indicated in the Contract.

3. **"Pavement, Thickened Edge (18 inch x 3 inch)",** per linear foot.

The Bid item price for "Pavement, Thickened Edge (18 inch x 3 inch)" shall include all costs for the work required to shape and compact the subgrade for the thickened edge including the concrete.

4. **"Underpinning, Cement Concrete CL 5 (3/4)",** per cubic yard.

The Bid item price for "Underpinning, Cement Concrete CL 5 (3/4)" shall include all costs for the work required to furnish and place the underpinning and reinforcing steel including as needed excavation.

5. **"Wall, Cement Concrete, Edge, Type 403",** per cubic yard.

The Bid item price for "Wall, Cement Concrete, Edge, Type 403" shall include all costs for the work required to construct the edge wall as shown on Standard Plan 403 including but not limited to excavation and disposal.

6. **"Wall, Cement Concrete, Support, Type 800",** per cubic yard.

The Bid item price for "Wall, Cement Concrete, Support, Type 800" shall include all costs for the work required to construct the wall as shown on Standard Plan no. 800. Payment for excavation, for disposal of materials, and for reinforcing steel (including steel extending into pavement slab) for the support wall shall be considered included in the Bid item price.

7. **"Wall, Cement Concrete, Curb, Type 801",** per cubic yard.

The Bid item price for "Wall, Cement Concrete, Curb, Type 801" (including reinforcing steel extending into pavement slab) shall include all costs for the work required to construct the wall as shown on Standard Plan no. 801. Payment for excavation, for disposal of materials, and for reinforcing steel for curb wall shall be considered included in the Bid item price.

8. **"Pavement Patch, Cement Concrete Class 6.5 (1-1/2), H.E.S.",** per cubic yard.

The Bid item price concrete for "Pavement Patch, Cement Concrete Class 6.5 (1-1/2), H.E.S." shall include the costs for the work not otherwise provided for in Section 5-05.5 but necessary to maintain and permanently restore, as applicable, pavements or other traffic bearing surfaces which have been opened by trench excavation or similar work. All incidental work required to complete the patching of street surfaces, including installing joints where required, shall be considered incidental to this Bid item. Pavement patching requiring full concrete pavement panel replacement will be paid as "Pavement, Cement Concrete (Class), (Thickness)" or "Pavement Base, Cement Concrete (Class), (Thickness)" as applicable.

9. **"Pavement Patch, Temporary, MC-250",** per ton.

Payment for "Pavement Patch, Temporary, MC-250" shall include all costs for the work required to furnish, install, and remove the temporary patch before final patching.

The costs for additional MC-250 and crushed surfacing Material required to maintain temporary pavement patches after the initial installation shall be borne by the Contractor at no additional or separate cost to the Owner.

10. **Other payment information.**

Payment for roadway ballast and crushed rock surfacing will be as "Mineral Aggregate, (Type)" per Section 4-01.5.

All costs in connection with replacing Portland cement with fly ash as specified shall be included in the Bid item price for the various classes of concrete involved. If the concrete is to be paid for other than by class of concrete, all costs involved with replacing Portland cement with fly ash as specified shall be included in the Bid item price for the applicable Bid item.

All costs required to furnish and mix additional Portland cement to concrete as specified in Section 9-01.4; to repair defective pavement slab as specified in Section 5-05.3(22); and to repair new pavement injured by frost action shall be considered defective work and will be paid in accordance with Section 1-05.7.

Cost for temporary pavement marking, Section 5-05.3(17), shall be considered incidental to the pavement Bid item.

Payment for backfill and compaction of trench subgrade shall be included in the Bid item price for the trench Bid item.

Payment for steel reinforcing bar for reinforced concrete pavement and for bridge approach slab will be paid separately in accordance with Section 6-02.5.

Steel required for tiebars, dowels, curbs and pavement, and for reinforcement around castings will be considered included in the Bid item price of the pavement Bid item and no separate or additional payment will be made.